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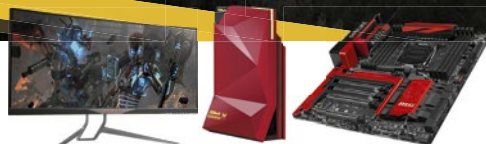
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COMPUTEX 2015

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SHOW TIMES

Computex is hot hot hot

There is no doubt that Computex week is the big one on the PC tech calendar. Like all trade shows – at least the big established successful ones – if you're a player you need to be there. We are, as should be magnificently clear, players of the highest order, so a posse of four Nextmedia crew hit it and hard.

As always, it was stinking hot and the show itself was welcome respite from the blazing Taipei tropical heat. There inside, is to be found the standard trade show hierarchy. At the top of the food chain are the Big Three of Taiwan: Gigabyte, Asus and MSI. The effort these guys put into a display is essentially what you would expect of Electronic Arts at E3 or Ford or Holden at the Motor Show. The bigger the better, and that means size, number of products and general buzz. Asus delivered the nicest stand. Gleaming glowed white and with loads of open space that flowed nicely as you wandered through, it wins my award for most impressive display. MSI was totally chaotic, because the arrangement of the display areas appears to have been designed to compress people into spaces too small for people. MSI also either invited half the company, because you just couldn't move for all the MSI shirts clogging the arteries. If indeed it was a treat for proud staff, then all gripes are void and good on em.

Equally large and just as brightly fantastic are the areas for Major Players who are sort of obliged to be there, but aren't really into the product showcase thing. These would be Intel, which had a fabulous multi-level area that was mostly empty the whole show, and Microsoft, also huge, also mostly empty. Intel was there to talk tech, and the Thunderbolt 3 announcement is

a great thing, but that's not really why people go to Computex. It's all about the product. Microsoft had product, if you like the Surface 3/Pro. Alas, the Computex aircon system wasn't up to the task of keeping heat entirely out of the show area, so with a mix of sympathy and amusement we observed a large crew of men with saws disassembling a couple of Microsoft's larger display cabinets on the morning of Day 1, roughly cutting big emergency ventilation holes and hastily hammering it all back together. Something was crashing badly in that heat and the confines of a poorly designed display area so hats off to whoever decided to brute force a quick solution.

90% of the rest were mid-tiers, all battling for attention. Computex is always packed with extremely interested people, and to its and everyone's credit it's exceedingly rare to see those sad cases of Show Face, where mindlessly bored staff stare forlornly out at passers-by from their boring empty stands, hoping someone will be kind enough to step in for a free lolly and a business card.

The takeaway from Computex 2015 is that everything revolves around Intel's Skylake CPU. When it hits in September the peripheral and component scene will explode with the many products that are mostly all ready and sitting in a warehouse somewhere for Skylake September.



Ben Mansill
Editor

bmansill@nextmedia.com.au

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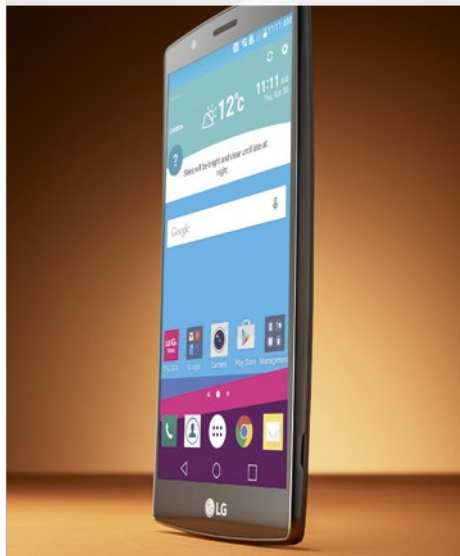
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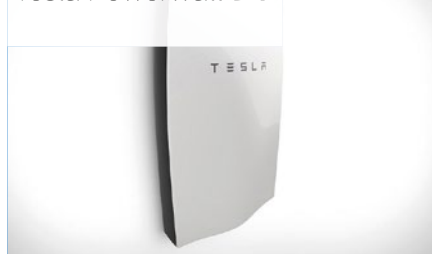
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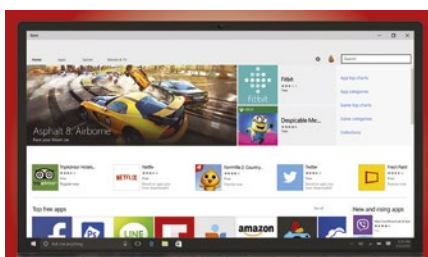


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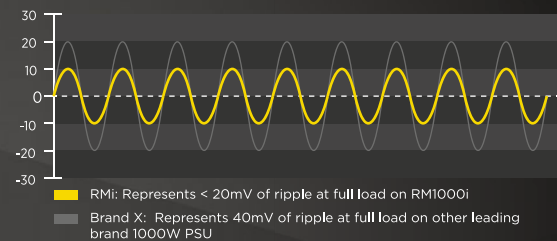


PREMIUM COMPONENTS DELIVER EXCEPTIONAL PERFORMANCE

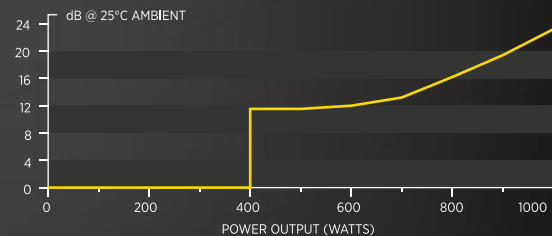
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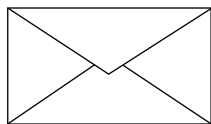


SSDs

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INBOX

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INDEX THIS

When I purchased my Windows 7 laptop four years ago I used Windows Experience Index to purchase what appeared to be the best laptop in my price range. Several had similar specifications, but the one I selected had the best MS rating. I used the comparisons as I believed it helped demonstrate which one had the best component integration.

It was relatively easy (at the time) as I simply opened System in the Control Panel on each laptop and compared results. The differences for similar specs were shocking.

With Windows 8 & 10, MS has removed the graphical interface, making comparisons much more difficult. While there is no doubt there are better real world tests, I believe the MS Index makes a very good basic system comparison and is possibly the reason manufacturers demanded it was removed.

In-store comparisons are now impossible, so published figures for every machine reviewed would be most welcome.

Peter Bailey

BUSHPHONES

Paul Ockenden's article on cheap Chinese phones (*PC & Tech Authority* May 2015) was interesting, but his contention that they compete with the current crop of more expensive high end phones mostly also made in China depends on what you want. If most people are happy to have a phone with previously common and useful features missing (but are often still available on low end phones) fair enough, but SOMEBODY should make a phone with all those features for people like me who go out in the wilderness for a week at a time and want the phone to last a week and be able

to carry everything on it to avoid needing several devices. A small market perhaps, but when they make something suitable then take it away in the next models I find it annoying.

My current phone, a Samsung Galaxy S3, has the following features I won't do without, and which most models of newer phones are missing some of. I need a removable battery for a week in the bush. Spares are small, light and hold their charge, and there is no loss putting one in, unlike external battery packs which lose charge in the transfer process, are bulky and expensive. I tried a bag full of them on a week's kayak trip, they worked but gave only around half the stated charge, and are bulky and heavy.

Second a micro SDXC slot. I could do without this if they made phones with large capacities, but only Apple makes one with 128GB of internal storage. No one seems to have commented on this, why have other phone manufacturers not done this, storage is cheap and getting cheaper? I do prefer a microsdxc card, though, as keeping all your stuff on it makes it relatively indestructible and easy to transfer to a new phone.

Third FM Radio. Sony, HTC still have one, I suspect Apple never has because they don't want you to access free audio, they want you to buy it off iTunes, but Samsung removed the FM radio in the S4, why? You can't stream radio over the internet in poor 3G reception areas, in remote areas, (eg in the middle of Bass Strait on the ferry), and when overseas you will incur possibly horrendous data roaming charges.

I checked out the Chinese phones Paul mentioned, none match the features I already have.

The current crop of so called smart phones reminds me of a car with no CD player, no spare wheel or jack, spark plugs you can only get at by removing

the engine, and the other silly ideas some current car makers seem to have. It doesn't endear their customers to them, just makes us all suspicious they are out to force us to continue the crazy upgrade cycle, when greens and governments are telling us to reuse and recycle.

Philip Dawson

LOOKS LIKE WIN 7

Hi, I am the "tech guy" at work. We have four computers and I am the fix-it / backup guy for them.

I purchased an Acer Aspire XC603 loaded with Win 8.1 64 bit to replace an older win 7 32 bit computer used by my boss

for the admin work and I promised that the new operating system would look and operate the same as the old one.

Yes I thought I would be able to install Windows 7 and use Windows Easy Transfer plus a few hours installing the programs.

Be warned you can't "downgrade" this model as the bios has built in protection and won't allow you to unless you flash the bios. I wasn't about to chance bricking a two day old computer so I agonised over trying to make Win 8.1 look like Win 7.

Luckily I had only partitioned the drive and not formatted it. I installed Classic shell which gave me the Win 7 look.

I came across the software program that should be in every computer tech's tool kit.

It is Laplink PCmover. I had cloned the old drive to a removable USB drive.

I installed PCmover which scanned the old drive and then commenced to transfer everything to the new computer including all keys. Programs transferred included MYOB, office 2003, Livemail and Omni form along with all settings and documents.

All up took about two hours. Everything worked perfectly which really surprised me.

Graham Marsh

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TECH NEWS

The latest trends and products in the world of technology

THE FUTURE ACCORDING TO GOOGLE: ANDROID M, BRILLO AND MORE

Google I/O played host to announcements on the next version of Android, Project Brillo for smart devices, and other plans for the future. **Nicole Kobie** reveals what it means for you

Google has laid bare its plans for Android, smart homes and wearables at its annual developer conference, Google I/O, announcing extensions to its Now smart assistant, an OS for the Internet of Things, and updates to Android Wear.

Head of Android, Chrome and Apps Sundar Pichai revealed that a billion people now actively use Android. While that usage is predominantly on phones, Google has plans to extend Android into our homes, onto our wrists and beyond.

"Google I/O underlined the company's ecosystem advantage by virtue of the Android installed base, user knowledge, machine learning and integrated services," said Geoff Blaber, an analyst at CCS Insight.

One area that lacked excitement was Android Wear: with the launch of the Apple Watch, many analysts had predicted this would be the year of the smartwatch, but Google had little news for its own platform.

Blaber suggested that the smartwatch OS has yet to reach mainstream status, remaining "firmly in the early development phase", although Google did impart that its wearable platform now has 4,000 applications for smartwatches. That includes an update to taxi app Uber,

letting you say "OK Google, call me a car" to book a cab, plus an emoji tool that lets you send an icon by drawing it on the watch face, which drew audience applause.

M IS FOR MERINGUE?

We also learnt more about Google's mobile OS, Android M. Google hasn't yet unveiled a dessert-themed nickname – we're hoping for "meringue" – but the search giant did divulge that it will arrive in the third quarter of this year, and will feature built-in support for fingerprint sensors and USB-C, simpler permissions (so it's clearer when an app wants access to your camera or data), and Android Pay, its own mobile-payments system.

Google is also making it easier to use Chrome in apps: when you click a link you'll be taken to a full browser page rather than a cut-down version. Google also said that Android M will as much as double battery life on standby using a power-management feature called Doze, which uses motion detection to determine if your device is unattended and turns off background activity.

✓ Google's Sundar Pichai (inset) revealed the company's plans to extend Android into our homes and beyond

Those changes may seem small, Blaber said they could be significant for many users. "Android M is an iterative update that delivers important security and user improvements, but most notably seeks to address a core business model challenge by better integrating apps and the web," he said.

One intriguing new feature is Google Now on Tap, which brings the Google Now smart assistant into apps. If a friend suggests a restaurant in a messaging client, for example, you can pull up Now while still inside the app to find out where it is and retrieve reviews. Google Now on Tap will use context, so you can ask "Where is this?", rather than actually name the restaurant.

INTERNET OF BRILLOS

Project Brillo is Google's step into the Internet of Things, extending Android to smart-home devices. It's not the search giant's first attempt at pushing its mobile OS into smart homes; four years ago, it used its developer conference to unveil Android@Home, but the initiative failed to take off.

With its second try, Google is using a cut-down version of Android. "Brillo is taken from Android, but we've taken the lower layers, the kernels, the core essentials so it can run on devices with minimum footprint; we've whittled it down," said Pichai.

Google's senior vice president also unveiled Weave, a communication layer for IoT devices. "It's a common language," he said, noting it will work across different platforms, not only Brillo. That means you can send a single command to your home hub and have it understood by all your devices, rather than having to open a fresh app for each connected item to tell it you're on holiday for two weeks, for example.

Brillo and Weave are only the latest entrants to IoT standards, with each tech firm seemingly adopting its own. "Google's Brillo and Weave IoT





announcements represent further evidence of growing standards fragmentation,” warned Blaber. “Nonetheless, the moves stand to better integrate Google’s own offerings and underlines the company’s strength by virtue of its raft of services and Android

< Despite the imagery, news on Android Wear was thin installed base.”

A developer preview of Brillo will be released in the third quarter of the year, while Weave is expected by year end.

MORE DATA THAN EVER BEFORE

As ever, Google’s push into new areas raises fresh concerns over data privacy. Alongside its IoT plans – which will see Google collecting and using data from devices in the home – the company also updated Google Photos (see What else from Google?, below) to offer unlimited storage, hoping to encourage users to keep all their snapshots in its cloud.

Both moves mean Google is going to be hosting even more data from its customers, Blaber warned. “It’s increasingly clear that consumers are sleepwalking into a world where huge swathes of their personal data resides with Apple, Google or both,” he said. ●

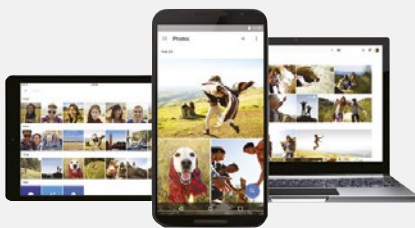
WHAT ELSE FROM GOOGLE?

GOOGLE PHOTOS

Photography fans will be keen to look at Google Photos, an extension to the firm’s existing photo-storage system. It aims to converge all of your pictures into one place, rather than leave them scattered across multiple devices and cloud storage.

Google Photos will organise images automatically, by dates, places and even people (without the need for tagging). The flipside is that this involves reading metadata and using facial recognition, so those concerned about privacy may prefer to avoid the free service.

While the search giant is offering unlimited storage, it’s setting a resolution limit of 16 megapixels for photos and 1080p for videos – sure to disappoint anyone with a decent DSLR. Google Photos is available immediately for desktop, Android and iOS.



FROM SMART JEANS TO ENCRYPTION

The Advanced Technology and Projects (ATAP) group at Google – perhaps best known for Project Ara, Google’s modular smartphone – had a host of new ideas on show. First up was Project Jacquard, a smart fabric that incorporates conductive wiring, which is being used by clothing manufacturer Levi’s to make smart jeans.

Also on show was Project Vault, an encryption tool in the form of an SD card with an ARM processor and NFC chip, letting you encrypt communications and securely store data.

Google also demonstrated Project Soli, a tiny radar sensor that can read the movement of your hands; fitting it into a smartwatch would enable the use of gesture recognition rather than tapping the screen.

CARDBOARD VR

Google showed off a new version of its Cardboard VR system, powered by your phone, which is slipped inside the low-rent container headset. The new version has been redesigned to work with any phone – including the iPhone – and to support it Google has released an SDK for iOS and a Cardboard app which is available on the Apple App Store.



Google also demonstrated Jump, a simple method to shoot VR video. Working with GoPro to make a 16-camera rig to record video for 360-degree applications, Google said it would release the design this summer so anyone can make a Jump rig. All you need to do is feed your footage into Google’s Jump Assembler tool to compile your stereoscopic video, then upload it to YouTube. (See p28 for our comprehensive guide to the other virtual-reality systems vying for success.)

The team didn’t announce any major updates to the Ara smartphone, but they did demo its modular nature by installing a camera to the phone after it was already running, and then taking a snapshot within just a few seconds.

HOT... OR NOT

HOT

INTEL THUNDERBOLT 3

In one stroke, Intel has elegantly given us what will probably be the next decade or two’s connectivity standard. It doubles the Thunderbolt 2 20 Gbps transfer rate, quadruples USB 3.1 speeds and all with a universal USB-C connector and 100w of power down the line to boot.



NOT

STYLE OVER FUNCTION

This month’s star culprit is the gaming headset. Priority #1 is to make them look like something Darth Vader would wear, so add lots of heavy plastic and some lights, then make the cup area crazy-shaped so it looks cool but fits no normal ear on the planet.



NEWS BITES

LENOVO SMARTPHONE USES PROJECTOR FOR KEYBOARD

Lenovo has revealed a concept smartphone that can project a display you can interact with, giving users a bigger touchscreen surface or keyboard. The Smart Cast system uses a built-in pico projector combined with laser sensors, but the technology isn’t expected to arrive in retail devices for another year or two.

WINDOWS 10 RELEASE DATE CONFIRMED

Microsoft has confirmed that Windows 10 will be released on 29 July as a free upgrade to those on Windows 7 and 8.1 (see p18 for our feature on Windows 10). Windows insiders – those who have been testing the new OS in beta – will also receive free upgrades.

GAMING NEWS

New things to put on your desk and head

OCULUS REVEALS CONSUMER-READY RIFT HEADSET

To come with an Xbox Controller and motion-tracking camera

Oculus has revealed the consumer edition of the Rift. The VR headset will ship with an Xbox One controller, a tabletop camera which tracks the LED markers on the headset to interpret head movement. The headset will display games through a combination of two AMOLED displays with low image persistence, which will reduce the chances of image burn-in and reduce blur. The headset's frame is wrapped in a cloth cover, though the reason for this is unknown.

Oculus' partnership with Microsoft means the Rift will run Windows 10 natively, and play Xbox One games via the headset. The partnership also means that this is the first time the headset will be shipped with a controller. Previously, players who wanted to use

more than their mouse and keyboard would have had to use workarounds, like a third party controller, or otherwise be limited to a built-in trackpad, like in the Samsung Gear VR.

With this in mind, Oculus has also been developing the Oculus touch, a set of hand-held, crescent-shaped, motion-tracking controllers. Using a combination of analogue sticks, force feedback,

and motion sensing technologies, the controllers will let players see and move their hands on screen, pick up objects, use weapons. This will increase immersion to new heights, letting players feel a greater sense of realism than ever before. What's more, the Oculus touch, by virtue of its nature, may require less practice on a user's part; unlike traditional controllers, the touch follows natural movements, even tracking gestures and finger motions.

Other features of the rift headset is its inbuilt headphones which offer 3D audio, along with the ability to wear glasses and the headset simultaneously, and stream games from the Xbox One to play on the headset.

A price is yet to be announced for the consumer Rift.



LOGITECH'S 'NEW' WHEELS

Crossing the line

Two issues ago (PC&TA 211), we let rip here on this very page at Logitech. We were more than a little disappointed about the company's apparent abandoning of the gaming peripherals scene – which hurts us because once upon a time, a long while ago, Logitech were the go-to brand for great gaming gear.

Now, in what should be great news, Logitech has announced two new wheel and pedal sets. There's the G920 for PS4, and the G29 for PC and Xbox.

So what has Logitech been cooking up in its gaming labs in the five years since the G27 was released, which in turn was based on ten year old G25 technology? 90% of nothing, it seems. The new wheels are mostly G27's with re-arranged buttons. The wheel is the same, the base is the same, the pedals are the same (though with a stiffer brake action). An awful lot of what we can see

in the new wheels comes straight from the G27 parts bin, with the most obvious exception of the new buttons.

The internal force feedback mechanism is still a twin-motor geared design, while the competition moved to belt drive years ago for all but extreme budget wheels. There's no load cell for the brake, which is another technology adopted by Logitech's competitors.

What is actually new is the price. We're told these wheels will be around \$500.

That's \$200 more than you can currently buy a G27 for. Also, the separate gear shifter from the G27 is now an optional extra. Still, at that price it's at least \$200 cheaper than Thrustmaster's T500 wheel and pedal set and several hundred dollars cheaper than Fanatec gear. Reviews to come.



msi

MSI recommends Windows.



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CHIP NEWS

Nvidia makes hay while the sun shines before AMD unleashes its Fury, and Intel launches its latest woolly products. **Mark Williams** checks out the latest in chip news

CPU

INTEL LAUNCHES BLACK SHEEP

E3 saw Intel launch its socketed desktop refresh CPUs as it waits for Skylake production to come online. The i7 5775C and i5 5675C are curious products to be launching. They're not any faster than the previous generation Haswell parts (namely the i7 4790K and i5 4690 respectively) in general compute tasks. However they do draw a whole 20W less power with a smaller 65W peak TDP rating while packing in their big ticket

item, the Iris Pro integrated graphics with integrated eDRAM, giving them quite a speed bump in the graphics department. So much so, they actually outperform the typically strong (in graphics benchmarks) AMD APU's by as much as 30%!

With the rumour mill suggesting an early August launch for Intel's new Skylake parts at the upcoming Gamescom event one has to wonder the reason for launching these parts at all with just two months of clear air to sell.

Perhaps they just wanted to show that

they can make parts that best AMDs APUs in all aspects. They do come at a high price though, literally. These new parts effectively will cost around twice as much as AMD's competing solutions.

So being too pricey if you only care about IGP performance, and not any better than Haswell parts on the CPU front it has to be wondered who these are aimed at?

Certainly they will be the pinnacle CPUs for any Socket 1150 system if you want an easy drop-in upgrade.

GPU

GTX 980 Ti

Nvidia's GTX 980 Ti snuck up on us pretty quickly. It went from being a quiet whisper of a rumour to a full blown card launch in less than four weeks. It was suspected Nvidia had these waiting in the wings ready to spoil AMD's new card releases, but it seems obvious that Nvidia got wind of AMD's R9 Fury's true performance and decided to ship the 980 Ti early to make some sales while they still owned the top end of the market.

The 980 Ti is a pretty sweet deal, almost all of the gaming performance of the Titan X but at a greatly lower price. Even the halving of the VRAM capacity to 6GB doesn't affect it at 4K and lower resolutions compared to the Titan X.

It seems Nvidia launched it just in time too, initial reports put the 980 Ti well below AMD's new R9 Fury X in performance.

See our 980 Ti reviews on pages 50 and 51 to get a full run down.

KUNG FURY

As expected E3 saw the launch of AMD's new card line up that we were expecting: the 300 series and Fury range.

The new 300 series consists of the R7 360, R7 370, R9 380, R9 390 and R9 390X. All of which can be summarized by saying they are rebrands respectively of the R9 260, R9 265/HD7850, R9 285, R9 290 and R9 290X cards. Most have simply had some minor clock speed improvements in the 5% range (50MHz) for the cores and up to 20% (250MHz) for

the memory which has also been doubled in capacity in most cases.

The sole exception being the R7 370, which being based on essentially the three year old HD7850, seems to have hit its limits, with no clock speed or capacity improvements over the R9 265. Being based on AMD's GCN 1.0 architecture also means it's missing things like DX12, True Audio and FreeSync support.

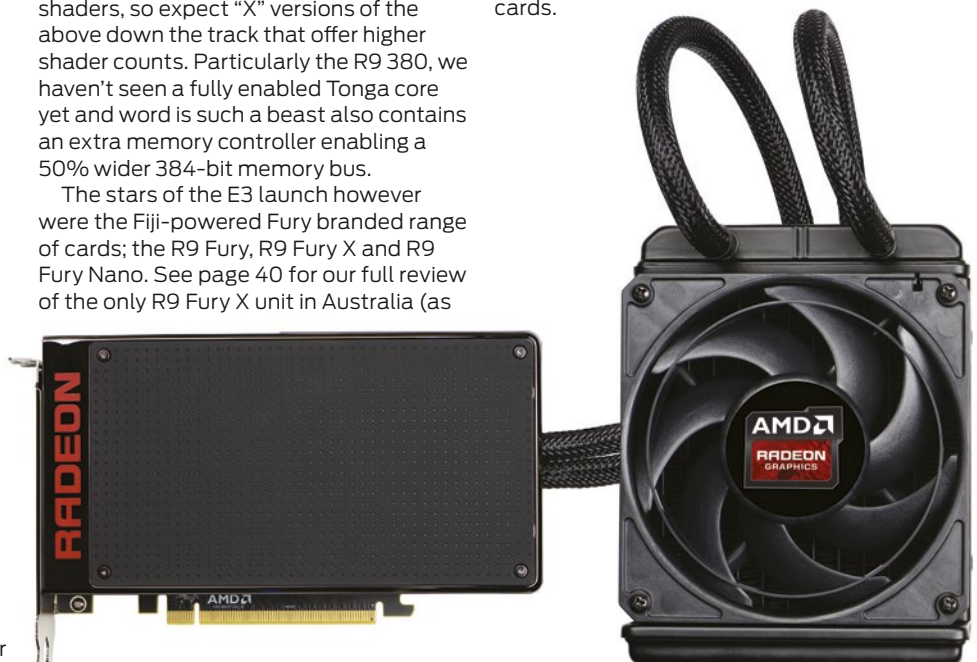
Interestingly all of the cards beneath the 390's all use cut down chips. None are equipped with a full complement of shaders, so expect "X" versions of the above down the track that offer higher shader counts. Particularly the R9 380, we haven't seen a fully enabled Tonga core yet and word is such a beast also contains an extra memory controller enabling a 50% wider 384-bit memory bus.

The stars of the E3 launch however were the Fiji-powered Fury branded range of cards; the R9 Fury, R9 Fury X and R9 Fury Nano. See page 40 for our full review of the only R9 Fury X unit in Australia (as

of right this second)!

The most intriguing of the Fury's launched though is the R9 Fury Nano. Claiming to have double the performance per watt of the R9 290X and double the performance density, at just 15cm long with a 175W TDP it'll be quite a compelling product.

Finally, there's an R9 Fury X2 on the way. All we know at this stage is that it sports two Fury X GPU's, will require less than 375W of power and still manages to be shorter than most current single-GPU cards.





It's a PC



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The World's First Intel NUC Mini PC with a USB Type-C Port



Black

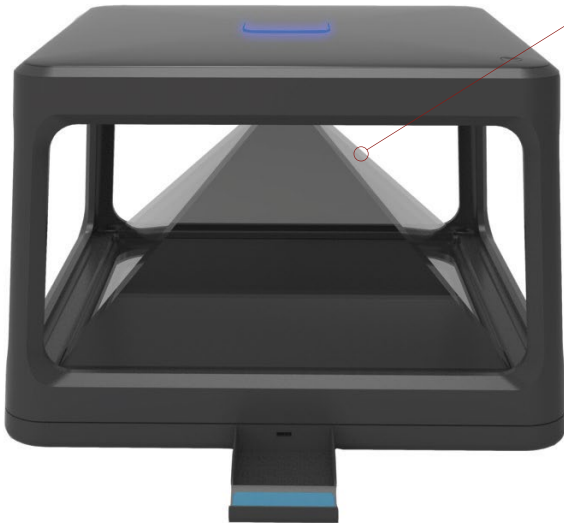
Gold

White



MOST WANTED

Rob North gets snarky about the latest tech you didn't know you needed



Holus

While the allure of the hologram has been somewhat displaced by VR-mania, there's something charming about the Holus. Capable of converting 2D content from paired devices into 3D holograms, the square-pyramid-shaped platform could lay a good foundation for further developments. With any luck, we'll be viewing recreations of Leia's iconic holographic plea for help in no time.

MOST WANTED: Canadian developers H+Technology see potential for the Holus to be used for teleconference calls, video gaming, and as a model viewer for 3D printing aficionados, and have bundled a SDK with the Pro model.

NOT WANTED: There's some serious marketing nous behind the cool concept, but don't get too caught up in the hype - it relies on the same 19th century parlour trick, the Pepper's Ghost Effect, that famously brought rapper Tupac back from the dead live at Coachella in 2012, and can't be considered a true hologram as you might think of the term.

SensorWake

Waking up in the morning is difficult. If you're looking for something a little more pleasant than the shrieking electronic beep of your alarm clock, SensorWake might be the thing for you.

MOST WANTED: Created by an 18-year-old French student, SensorWake is an alarm clock that relies on your sense of smell rather than hearing to get you out of bed. You can choose from a variety of fragrance capsules including bacon, freshly cut grass, coffee and money that will supposedly wake you up in under two minutes 99% of the time. But if you're still snoozing after 3 minutes, SensorWake will sound off a standard audio-alarm.

NOT WANTED: Wake up and smell the roses people - let's hope there's a white wine scent in the works, because this is a first world solution to a first world problem, with an expected price tag of 109€ (around \$160 at time of writing).



Phree

Racking up over \$800,000 in crowdfunding on Kickstarter, Phree is billed as the world's first write-anywhere digital pen offering users the ability to digitally record their notes and doodles in real-time on a Bluetooth connected device.

MOST WANTED: Whereas most digital pens require a tablet base or specific paper, Phree can write on almost any surface. It also has a pressure sensitive tip compatible with certain applications, allowing users to vary the width of their strokes.

NOT WANTED: Could the writing be on the wall for the device before it's even widely available? With the recent announcement of predictive touch technology in Apple iOS9 lending credence to rumours of Apple branded iPad styluses and the assumption that the Galaxy Note 5 will similarly feature a stylus, the thought of forking out extra dosh for a separate third-party peripheral (despite its unique features) suddenly becomes a little less appealing.

StarVR

It's getting harder and harder to keep up with the latest virtual reality developments, with seemingly everyone and their dog tentatively putting one foot in the potentially lucrative space. Starbreeze, the parent company of Payday 2 devs Overkill, are throwing their hat into the ring with StarVR.

MOST WANTED: The best reason to pay attention to StarVR is it's compatibility with Overkill's forthcoming The Walking Dead FPS. It also claims to address the field-of-view issues common to VR headsets. Whereas the Oculus Rift, Project Morpheus and the HTC Vive (aka 'that Valve one') all feature a 110 degree FOV, StarVR has a 210 degree FOV allowing for full peripheral vision.

NOT WANTED: Now, can we all agree that there are now way too many consumer VR headsets in the pipeline? Yes? Good.



HP Sprout 3D Capture Stage

The new peripheral device for their all-in-one creative workstation dubbed Sprout, HP's 3D Capture Stage is a turntable scanner that looks to make consumer and semi-professional 3D modelling and printing more accessible than ever before.

MOST WANTED: Relatively well priced at USD\$299 (on top of the necessary \$1899 Sprout computer), this is arguably the best end-to-end solution for those without CAD know-how looking to get their heads into 3D printing. You can simply pop your physical prototype on the automated turntable scanner, and the system will stitch together images of your creation to make a 3D model for editing or printing.

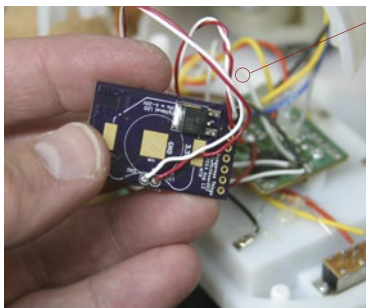
MOST UNWANTED: The Capture Stage only supports small and light objects, less than around 1.9kgs and no taller than 19cms.

Asus ROG Claymore

Computex 2015 treated us to a number of wonderful surprises, and one of the best of this year's show was Asus' middle finger response to Corsair's Vengeance K70 mechanical keyboard.

MOST WANTED: The Claymore is a brand new Cherry MX based keyboard (with red, brown, blue or black switches available) with 16.8M-colour backlit keys that can be individually customised. Leaving the aesthetics aside, Asus' keyboard comes with a fully programmable modular 10-key add on that can be attached to either side (functioning as a traditional numpad when tacked on the right-hand side) or kept separate.

NOT WANTED: It's difficult to find fault with the Asus ROG Claymore, but if we're being particularly picky it could do with a wrist rest out of the box.



Switcheroo

Switcheroo is a neat little gadget that allows you to retrofit almost any electronic device to a smart device controllable via your smartphone, meaning you won't have to replace all your existing junk including lights, car keys, toys and TV remotes to bring them into the 21st century.

MOST WANTED: Switcheroo creators Dangerous Things have gone the extra mile, with an open API and a few easy to follow Instructables guides so that everyone from the cluey tech-head to the average punter can get behind their product.

NOT WANTED: Better make sure you keep your smartphone charged, or you'll be suffering the shame of having to actually get off the couch and use your legs to operate your devices.

ENERGY RATINGS FOR COMPUTERS

Anthony Caruana investigates the lack of a common energy rating for computers

One of esteemed readers, Dennis posed the following question to us recently.

"Desktop computers are the dinosaurs of the digital age and I'm not sure that your fine magazine should be giving disproportionate coverage to the diminishing tribe of their owners"

Of course, minorities must be respected and given their due weight in your magazine. I am certainly not about to call any of your esteemed readers energy-sucking, greenhouse gas emitting vampires or anything of the sort.

But I wonder whether, if it is good enough to have energy star ratings on other domestic appliances, why they are not present on computers?

Perhaps you could kick things off by providing some energy-consumption figures on the machines you review, both when idling and in use?"

The challenge for the computer industry is that there is such a huge diversity in the market.

We decided to delve into the data on various manufacturer websites to see what information they actually provide. We focussed on desktops as laptop consumption can be highly variable depending on the myriad energy management technologies in play.

WHAT DATA IS OUT THERE?

Dell provides energy consumption data for its products but you will need to dig a little. If you select a product from Dell's website, you'll find a link to some regulatory documents including environmental datasheets. We looked through a few of the data sheets and found data regarding the maximum and idling power consumption, although it wasn't presented in a uniform way for every model in the range.

We couldn't find the same level of detail with Lenovo although we did note the company espoused its "Green Leadership" touting their compliance with Cisco's

"EnergyWise Certification". However, this is an energy management tool that focusses on monitoring energy use for a fleet of computers rather than the specific energy use by a single device.

HP's environmental efforts are pulled together under the "Living Progress" banner. But a look through their PC product information told us nothing about the specific energy use of their products. However, there is plenty of information about power use while active, idle or in sleep mode for their printer range.

Finally, there's Apple. A look through the specs for the iMac range reveals they meet the requirements of Energy Star version 6.1. They also provide detailed environmental information, in a clear and understandable form, for every single product they make and sell within their environmental responsibility reporting.

ENERGY CONSUMPTION RATING SYSTEMS

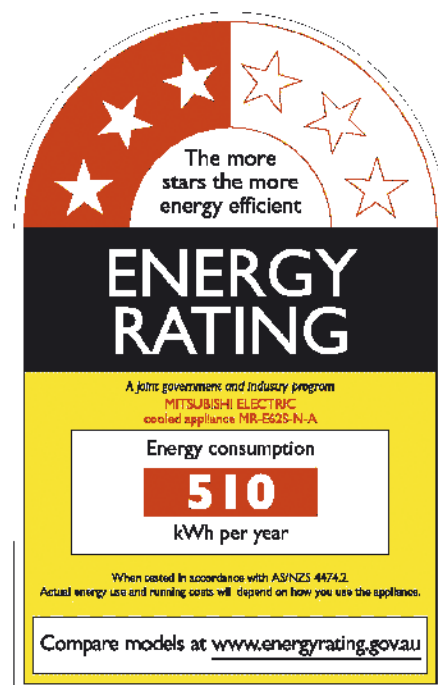
Walk through an electronics or appliance retailer in Australia and you'll see red and yellow stickers with some stars covered by a red semi-circular band. That's the Australian Energy rating system. It only applies to domestic fridges and freezers, washing machines, clothes dryers, dishwashers, air-conditioners, televisions, and computer monitors.

The labelling scheme is mandatory.

Energy Star is an international standard that was first developed in the United States but has been adopted by Australia, Canada, Japan, New Zealand, Taiwan and the European Union. Products that conform to Energy Star have a blue and white sticker. This is a voluntary program.

WHAT'S THE STORY WITH PCS?

Given there are systems and standards in place for providing consumers with information regarding their computer's energy use, why is the data so hard to find?



Computers are highly configurable and customisable devices so any energy consumption data needs to be considered in that context. For example, if you set your display to power off after a minute of inactivity, use wired rather than wireless peripherals, clock your CPU back and swap out the spinning hard drive for an SSD you can change the energy consumption characteristics of your computer significantly.

For companies like HP, Dell and Lenovo, we imagine providing detailed energy consumption data for every possible permutation and combination for each model would be incredibly difficult. Many models by those manufacturers offer three or four CPU options, each with its own specific energy use and with differing impact on overall energy use. Moving from 8GB to 16GB of RAM can have an impact as well with less data being written to hard drives.

Our advice – if power consumption is a big deal for you you'll need to delve a little deeper than the spec sheet. There's reporting information on some manufacturer sites but it might take some effort to find. And, we suspect it's that variability that stops PCs from having an energy ratings system.



Anthony Caruana has worked for almost every major masthead in the Australian IT press. As an experienced IT professional – having worked as the lead IT executive in several businesses, he brings a unique insight to his reporting of IT for both businesses and consumers.

NEED HELP? EVER HAD AN ISSUE AS A CONSUMER? INVESTIGATOR CAN HELP.

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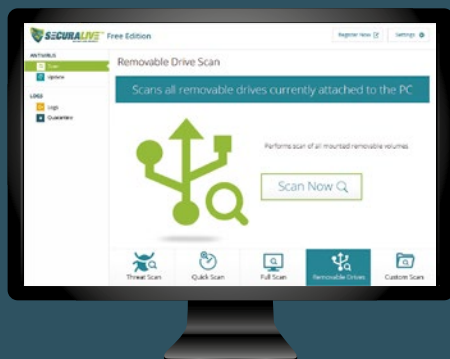
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- Data loss protection

The background of the entire page is a dark, textured surface covered with numerous overlapping, colorful rectangular outlines. These outlines, in shades of red, green, blue, and yellow, are arranged in a way that suggests a grid of windows or a fragmented digital space. Some outlines are solid, while others are partially cut off by the edges of the frame.

99

THINGS YOU NEED TO KNOW ABOUT **WINDOWS 10**

Windows 10 is Microsoft's most important operating system release since Windows 95. It's also the most ambitious, bringing new technologies, new ways of working across multiple devices and a whole new upgrade model. Here's everything you need to know, according to the latest information available – so when it's time to upgrade you'll be ahead of the curve.

HOW TO GET IT

BECOME A WINDOWS INSIDER

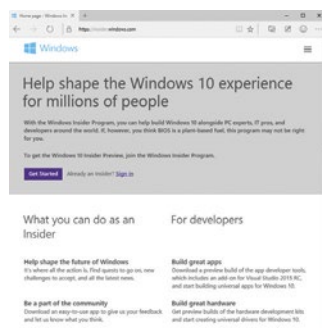
Almost four million Windows users are already test-driving a preview build of Windows 10. You can too, by signing up to the Windows Insider Programme (insider.windows.com). Through the Windows Feedback app, Insiders can also submit bug reports to Microsoft and vote on feature requests – so Windows 10 will be shaped by real user feedback.

WHEN IS THE OFFICIAL RELEASE?

At the time of writing, Microsoft hasn't set a firm date for the release of Windows 10, but all the signs are that it will be with us sooner rather than later, with final code potentially provided to manufacturers of PCs and tablets as early as mid-July. That would mean we'd see Windows 10 systems in the shops in time for the late summer "back to school" period.

WINDOWS 10 PREINSTALLED

It's long been a truism that the easiest way to upgrade to a new



OS is to buy a new computer with it preinstalled. For Windows 10, Microsoft has confirmed that new devices with screens smaller than 9in will qualify for a free OS licence. That means a lightweight Windows 10 tablet could easily cost less than \$200.

A FREE UPGRADE FOR CURRENT USERS

If you don't want to buy new hardware, the great news is that most current Windows users are eligible for a free in-place upgrade. The offer is open to anyone running Windows 7 or 8, and will run throughout the first year of Windows 10's availability. As long as your existing installation is up to date, you'll be able to download the new OS directly via Windows Update.

SHORT ON STORAGE?

Even compact tablets with limited storage should be perfectly able to run Windows 10 – but Microsoft has warned that they might not have enough space to download and install the upgrade. The publisher is "evaluating a couple of options" for working around this – our guess is that you'll need to copy the installation files onto an external USB device.

UPGRADING FROM VISTA AND XP

Windows 10 is designed to work smoothly on low-powered tablet hardware, so it should be usable even on older Windows Vista or even XP systems. But the upgrade won't

be free, and you'll have to perform a clean installation. There's better news for Windows Insiders: Microsoft intends to allow a direct upgrade from the Technical Preview to the final code.

RT NO MORE

Sad to say, tablets running Windows RT won't receive the full upgrade. Evidently, Microsoft has concluded that it isn't worth the effort of porting Windows 10 to the ARM architecture (even though Windows 10 Mobile is designed to run on ARM-based smartphones). There may be a consolation prize, though: a promised final update for RT devices could provide limited support for Universal apps.

THE INSIDER PROGRAMME CARRIES ON

Insider Programme members who've enjoyed trying out pre-release code may be ambivalent about the OS being released. But the programme doesn't end on launch day: corporate vice president Joe Belfiore has confirmed that Insiders will be given the option to carry on as pre-release testers for future updates, including Redstone.

HOW IS MICROSOFT GOING TO MAKE MONEY FROM WINDOWS 10?

With free upgrades to Windows 10 via lifetime updates, some have wondered how Microsoft will make money from its new OS. A subscription deal is a possibility;

Microsoft claims that it plans to offer Windows freely, or very cheaply, to create a market for apps and services.

FREE FOR PIRATES?

Microsoft's Terry Myerson caused confusion in March by stating that even "non-genuine" installations of Windows 7 and 8 would receive a free upgrade. Microsoft has now clarified that installations upgraded in this way will be flagged as non-genuine – but those upgrading from a pirated installation of Windows 7 or 8 will be offered a cut-price deal on a legit Windows 10 licence.

MOVING UP TO REDSTONE

After Windows 10 arrives, it's already been suggested that we'll see a first update in October, adding features that didn't make it in time for the launch. Then a major update codenamed Redstone is slated for summer 2016. Reportedly, Redstone will improve support for new devices such as the HoloLens and Surface Hub – but we'll have to wait and see.

WINDOWS-AS-A-SERVICE

Windows boss Terry Myerson has said that Windows 10 will usher in the age of "Windows-as-a-service". In other words, future OS updates will be rolled out for free as soon as they become available – so there won't ever be a big landmark launch of Windows 11. It's a huge change in the way Microsoft distributes its most ubiquitous product.

THE LITTLE BITS

WINDOWS

Hello, goodbye passwords
Windows 10 includes a new technology called Windows Hello that can identify you biometrically – for example, using a fingerprint reader or iris scanner if your computer has one. It's faster and easier than entering a password. A

technology called Passport will let you use your Windows identity to identify yourself to third-party websites and applications.

COMPRESSED SYSTEM FILES

The Windows system folder can take up 15GB or more of storage.

Windows 10 can automatically compress these system files to save space, expanding them dynamically as needed, to help the OS fit onto low-specification devices.

UPDATED COMMAND PROMPT

The command prompt harks

back to the MS-DOS days, but in Windows 10 it gets a modest update: at last you can freely resize command prompt windows, and select, copy and paste text just as you can in regular Windows applications. You can also adjust the opacity of the window, if you don't like staring at a big black box.

THE NEW START MENU

LOOK WHO'S BACK

Perhaps the biggest news about Windows 10 is that the Start menu is back. For Windows 8, Microsoft was insistent that it was gone for good, replaced by the more touch-friendly Start screen. Happily, in Windows 10 the firm has seen sense; for those on conventional laptop or desktop hardware, this updated Start menu is now the default application launcher.

RECENT APPS

The Windows 10 Start menu offers shortcuts to recently used applications, and those most recently added. Click "All Apps" and you'll see an alphabetical list of everything on your system. It's a bit annoying that this is stuck into a single column, though, while the Live Tiles eat up screen space. Recent documents aren't stored here either – something that could be added in a future release, perhaps.

SEARCH BOX

The familiar search field has gone from the Start menu; now,



if you hit the Windows key then start typing, your input is sent to Cortana. In practice, it works just as before – apps and desktop applications appear at the top of the list, and can be launched by simply hitting Return. As Cortana's capabilities evolve, it could end up being more useful than the old Search function.

LIVE TILES

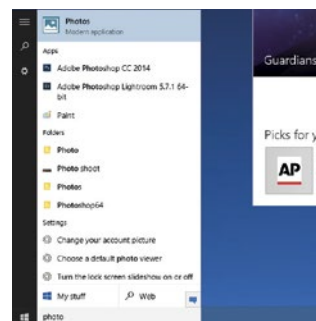
While the Windows 10 Start menu looks familiar, it actually functions as a standalone Modern app. You can see that in its appearance, and in the styling of text and menus. The Start menu also shows the Live Tiles that formerly occupied the Windows 8 Start screen, presenting dynamic information – from email notifications to news and weather alerts – from enabled Modern apps.

RESIZING THE START MENU

The default Live Tile area offers horizontal space for a grid of 4 x 4 medium-sized tiles, with the ability to scroll up and down to view additional tiles. New in Windows 10, you can also resize the menu: drag the upper edge to set the default height, and extend the side across the screen in multiples of four tiles. You can't hide the tile area altogether, however.

UNINSTALL FROM THE START MENU

Windows' Programs And Features interface is straightforward enough, but it's



buried away in the control panel, where it can be a drag to open it up and find the application you want to uninstall. Windows 10 provides an Uninstall link directly on the Start menu, for both desktop and Modern apps – a small but welcome step towards easier housekeeping.

SHUT IT DOWN

In the original release of Windows 8, the Shutdown and Restart controls were hidden in a hard-to-find Settings pane – leaving beginners unable to figure out how to turn off or restart their devices. In Windows 8.1, Microsoft wisely moved the power button onto the Start screen; in Windows 10, for desktop users, it sits conspicuously at the bottom of the Start menu.

RESIZING LIVE TILES

For Modern apps, four tile sizes are available – small, medium, wide and large – and you can resize them with a right-click, drag them around and organise them into named groups. You can also pin the apps they represent to the taskbar, or remove them from the Start menu. In an OS

where Modern and desktop apps live side by side, the Start menu keeps everything together fairly neatly.

TILES FOR DESKTOP APPS

As it was in Windows 8, it's possible to pin desktop apps to the Live Tiles area – although they won't show any live information, of course. Only small and medium-sized icons are available, but right-click and you'll see extra "Run as administrator" and "Open file location" options – potentially useful, as these options aren't available from pinned taskbar icons.

FULL-SCREEN START

While we're delighted to see the Start menu back, on a small tablet the old Start screen made a lot of sense. Windows 10 lets you switch to a full-screen interface by clicking the Expand icon at the top right of the menu. The full-screen view, showing apps and tiles, is the default interface in Tablet mode – but you're free to use it in Desktop mode if you wish, and enjoy the best of both worlds.



THE LITTLE BITS

ONEDRIVE SELECTIVE SYNC

In Windows 8, the OneDrive Explorer folder displayed all your files that had been uploaded to Microsoft's cloud service – but this didn't necessarily mean they were all present on your computer. In order to save space, Microsoft implemented a system whereby remote files could be

stored offline and downloaded as needed. Now it's concluded that this behaviour isn't clear enough to keep users happy – so in Windows 10 it's moved to a simpler model that only shows files that are actually on your hard disk.

CALCULATOR

It's a small change, but a

symbolic one: the familiar Windows Calculator tool, barely changed since Windows 95, has been replaced in Windows 10 with a new Modern calculator app. All the familiar options are still available (including unit conversions and Scientific and Programmer modes), but it's a clear illustration of how Modern apps can now fit happily into a

desktop workflow.

PRINT TO PDF

Windows has long supported the XML Paper Specification (XPS) – a kind of alternative to PDF – and if you don't have a physical printer connected, then the Print function in Windows 7 and 8 will default to generating an XPS document. The XPS

NEW TECHNOLOGIES

EDGE BROWSER

New editions of Windows have traditionally brought a new release of Internet Explorer, but Windows 10 replaces it with a new, fast and lightweight default browser - originally codenamed "Project Spartan" but now officially called Microsoft Edge. Its feature set is limited, but since it's a Universal app it has a very light footprint and works with both laptops and tablets.

SECURITY ON THE EDGE

Edge also benefits from the sandboxing built into the Universal app framework. As a result, it's far less vulnerable to hackers and drive-by downloads than Internet Explorer ever was. So confident is Microsoft in the robustness of its new browser that it's offering a "bug bounty" of up to US\$15,000 for anyone who manages to expose a security vulnerability.

THE REMNANTS OF IE

The Edge icon is a stylised blue "e", symbolising Edge's

replacement of the old Internet Explorer. And internally it marks a break from IE: old technologies such as ActiveX and Browser Helper Objects aren't supported. However, some sites still rely on the quirks of IE - so the old MSHTML engine is included as well, enabling Edge to fall back into a legacy mode.

THIN ON FEATURES

The Edge browser has some interesting new features: the Reading List lets you save pages to read offline (perhaps on a different device), while on a tablet you can use a stylus to annotate web pages and share your notes with others. Currently, though, many features you might take for granted are missing, including private browsing and a searchable browsing history.

THE BEST OF BOTH WORLDS

In online benchmarks, early preview code of Project Spartan proved slightly slower than IE11, giving rise to the idea that the new browser had sacrificed speed for simplicity. The latest builds show progress, however,

with Microsoft's new browser outpacing both Chrome and Firefox, providing one argument for giving Edge a try right away.

CORTANA

Cortana debuted last year on Windows Phone as a voice-controlled "digital personal assistant" - effectively, Microsoft's answer to Siri. In Windows 10, it retains its natural-language processing abilities, so you can enter commands such as "what's the weather going to be like tomorrow?" or "set an alarm for 7pm" - although we've found results very hit and miss so far.

TALK TO ME

Cortana also retains voice-recognition capabilities: click the microphone icon and you can start asking questions using your device's microphone; Cortana learns your voice over time, although we found accuracy was pretty good straight out of the box. An optional feature called "Hey Cortana" sets the OS into an always-listening mode, so you don't even need to click.

CORTANA AND APPS

Cortana's final trick could prove very powerful indeed, if app developers take advantage of it. Apps can integrate with Cortana so that specific functions can be accessed by voice control. The built-in apps provide an early example of what's possible: instruct Cortana to email a friend and the Mail app should pop

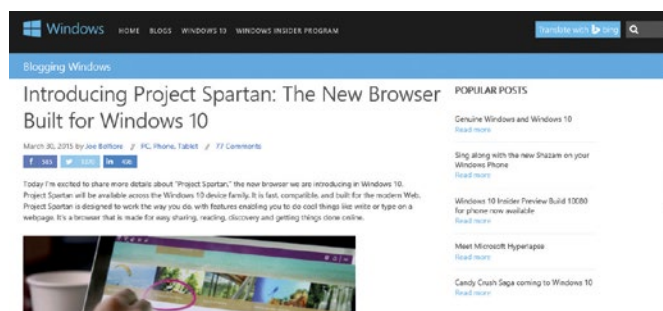
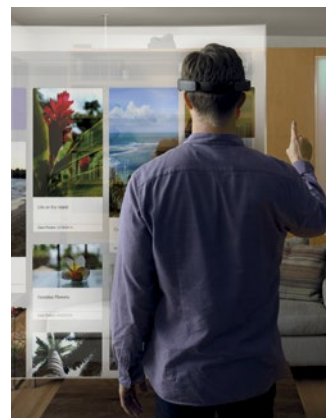
up with the address field pre-populated.

WINDOWS HOLOGRAPHIC AND THE HOLOLENS

Windows Holographic is a new set of tools and APIs in Windows 10 that allows apps to display 3D images on a pair of smart glasses. It could be used for virtual-reality gaming, but the flagship device is the HoloLens, a Windows 10-based augmented-reality visor controlled by voice commands and hand gestures.

A VIRTUAL APP GALLERY

The HoloLens has possible applications in fields such as engineering, design and architecture - and it can also create enormous virtual displays. Any Universal app or video file can be overlaid (within the visor) onto a blank wall (in real life). However, the HoloLens isn't fully immersive: the projected display doesn't extend into your peripheral vision.



format has never gained widespread adoption, though, and in Windows 10 the default driver is replaced with a new Print To PDF function.

SYSTEM REQUIREMENTS

As we've noted, Windows 10 is designed to work on very lightweight hardware as well

as more powerful systems. Officially it requires 1GB of RAM for the 32-bit edition - or 2GB for the 64-bit OS - a mere 16GB of storage, and a display resolution of 800 x 600.

CERTIFIED TABLETS

Microsoft has relaxed the design requirements for Windows tablets; the physical Windows

button is no longer required for Windows 10 certification, paving the way for some minimal tablet designs - although power and volume buttons are still a must.

SECURE BOOT IS HERE TO STAY

As with Windows 8, all computers and tablets sold with Windows 10 will be required

to use Secure Boot, making it harder for malware to tamper with the system. In a notable change, however, it's no longer required that manufacturers allow the user to configure Secure Boot themselves. That might prove controversial, as it means we might see Windows 10 devices on which it's completely impossible to install

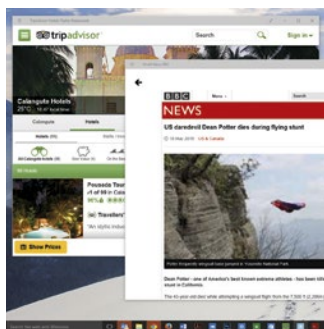
UNIVERSAL APPS

WRITE ONCE, RUN ANYWHERE

Apps that use Microsoft's new Universal framework should run across all Windows 10 PCs, tablets, phones and other devices, adjusting themselves to suit different screen sizes. The apps look similar to the first-generation Modern apps that accompanied Windows 8; the hope is that enabling them across all your devices will make them more popular.

OFFICE TOUCH APPS

To show the potential of Universal apps, Microsoft has rolled out Windows 10 versions of Word, Excel and PowerPoint, with simplified controls to suit touch devices. The apps are free to download; the plan is to bundle them for free with smartphones and tablets, while perhaps charging extra for more capable Office 365-compatible versions.



APPS IN WINDOWS

In Windows 8, tablet-style apps could only be run in full-screen mode (or in limited split-screen

arrangements). When Windows 10 is in Desktop mode, each Modern app opens in its own window, alongside your desktop applications. Trying out and playing with apps feels much more breezy and natural, with no need to keep switching between views to multitask.

A SHARPER LAYOUT

Updated design guidelines mean that Universal apps should be more attractive and usable than their forebears. Where Windows 8 emphasised big text and white space, Windows 10 allows apps to be laid out more like web pages, with a greater use of links and scroll bars, and no more need for "edge-swipes". As a result, less space is wasted and it's easier to see at a glance what you can do.

A FREE FRAMEWORK AND NOT ONLY ON WINDOWS

Microsoft's free Visual Studio Express lets amateur developers create Universal apps without paying a penny. And at this year's Build conference, Microsoft revealed Visual Studio code editors for OS X and Linux, so developers on other platforms can also get in on the action.

PORTING APPS FROM OTHER PLATFORMS

Also at Build, Microsoft unveiled new SDKs allowing established developers to import Android and iOS apps into Visual Studio and adapt them to the Universal

app framework. Clearly the company recognises that Windows 10 needs more apps in the Store - and the new SDKs will encourage developers of existing apps to bring them across.

HOSTED WEB APPS

Another innovation in Windows 10 is hosted web apps. Like Chrome apps, these are fundamentally HTML5 applications - games, productivity tools or anything else - that can be downloaded and stored locally on your device, so you can use them whether or not you're connected to the internet. It's another measure aimed at helping developers create content for Windows 10.

MORE PURCHASING OPTIONS

Developers rarely work for free, and Microsoft is promising a very wide range of payment options for the Windows 10 Store, including the ability to sell recurrent subscriptions to services. Developers can choose whether customers will

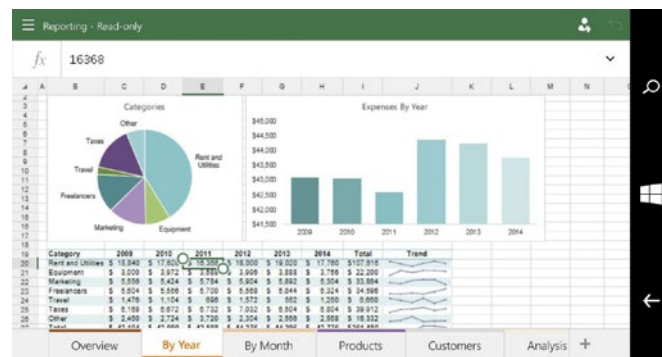
be allowed to buy an app once and run it on all their devices, or whether separate platforms must be paid for individually.

HOST YOUR OWN STORE

Universal apps are quick to create, sandboxed to minimise security concerns, and able to run on a huge range of hardware, so it's a tempting platform for businesses looking to develop in-house apps. Microsoft plans to let enterprise customers curate their own internal Windows Store, providing bespoke software to authorised visitors.

BEYOND WINDOWS?

Since the Universal app framework already runs on ARM, some have suggested it could in future be ported to other platforms, such as Android or OS X. Microsoft hasn't revealed any such plans, but it has said that it wants to "help people do more on the device they choose". With Office apps already available on iOS and Android, the idea isn't wholly far-fetched.



THE LITTLE BITS

a different operating system.

WINDOWS SPOTLIGHT

A new feature called Spotlight allows Windows to show live content on the lockscreen while you're away from your PC. It's been suggested that Microsoft might use this to highlight features of the operating

system; others have noted that it could be used for advertising.

AUTOMATICALLY UPLOAD IMAGES AND VIDEOS TO ONEDRIVE

Windows 10 includes new OneDrive AutoPlay options: when you mount an SD card or attach a smartphone,

the operating system can automatically import your pictures and sync them up to your OneDrive account. A similar auto-upload feature was already available in the OneDrive smartphone client, but the idea hasn't previously been supported on the desktop.

NO MORE RECOVERY IMAGES

Recovery partitions and images eat up storage space, and not all the devices Windows 10 is aimed at have much to spare. So, in the new OS, you won't need to keep an entire spare copy of the installation files hanging around in case of disaster; Microsoft has said you'll be able to revert your

DESKTOP IMPROVEMENTS

THE NEW SETTINGS APP

The Windows control panel is a labyrinth. Windows 10 introduces a shiny new Settings app with a cleaner hierarchical interface that helps you discover and access configuration options. It looks a bit like Windows 8's PC Settings app, but it offers many more controls, so you don't need to keep switching back to the old control panel.

THE NOTIFICATION CENTRE

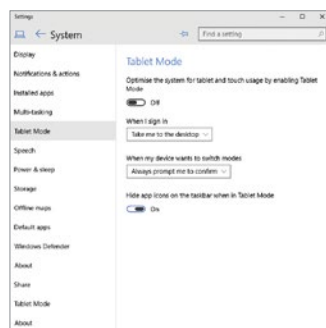
In previous editions of Windows, notifications used to pop up and then vanish. Windows 10 collects them together in the new notification centre, for you to review by clicking the icon in the system tray. The panel also offers one-touch shortcuts to let you quickly switch to Tablet mode and access settings such as screen-sharing and brightness.

A SMART NEW LOOK

The Windows 10 desktop benefits from some distinctive visual changes: many system icons have been redesigned, and there are now bigger, softer drop shadows around windows, making it easier to see at a glance what's on top of what. Not everyone is a fan, but next to Windows 8 with its garish indigos and oranges, we think Windows 10 looks more confident and professional.

TABLET MODE

The ability to switch between



the Start menu and a full-screen launcher isn't the only adaptation for tablets and convertibles. The new Tablet mode is the default for devices with touchscreens smaller than 10in: activate it and applications instantly jump up into full-screen mode, with bigger, touch-friendly taskbar icons. Disable it and everything returns to regular desktop scale.

BYE-BYE CHARMS

Windows 8 introduced "charms" – a menu of OS and app controls that appeared when you swiped in from the right-hand side of the screen. In Windows 10, the charms are gone, their functions divided up between the notification centre, the Start menu and individual app settings. Microsoft deserves credit for trying something new, but the charms never worked well.

TASK VIEW

Click the new Task View button on the taskbar and all your open windows fly into a tiled overview, so you can see what's running at a glance, and click

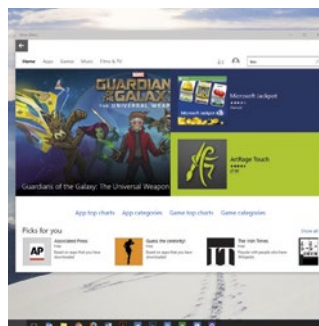
on a thumbnailed window to activate it. In use, it's very similar to OS X's Exposé feature, but that's no bad thing. You can also open the Task View by pressing Windows+Tab – a better use for it than the Flip 3D feature of old.

MULTIPLE DESKTOPS

In the bottom right of the Task View, an unobtrusive icon invites you to add a new desktop. Yes, Windows 10 lets you set up multiple desktops, each with its own applications and windows – handy for those who like to set up specific workspaces for different projects. You can switch desktops in the Task View, or by holding down Windows+Ctrl and pressing the left or right cursor key.

UPDATED NETWORK SETTINGS

The Network And Sharing Centre, introduced in Windows Vista, has always been a bit of a mess. Windows 10 introduces a new pop-up view for wireless networks, making it easier to see and connect to your chosen network. The pop-up also offers



an accompanying shortcut to the network-configuration page in the streamlined Settings app.

IMPROVED SNAP

Windows 7 introduced a feature called "Aero Snap" that let you dock a window to the side of the screen by dragging it against the edge. Windows 10 improves on this: once you snap a window to fill half of the screen in the new OS, your other open windows are arranged into a Task View-like preview, from which you can easily click on one to make it fill the other side of the screen.

QUICK ACCESS

The Windows Explorer has been renamed File Explorer, and the old Favorites list has been replaced by a new list called Quick Access. This may appear to do the same thing, but it includes self-updating shortcuts to the last few folders you accessed – a real time-saver if you're switching back and forth between folders. To pin a shortcut here permanently, simply click the pin icon next to it.

A NEW LOOK FOR THE TASKBAR

Windows 10's taskbar icons are more compact than in previous editions of the OS, and open apps are indicated by an underlining effect. We're not fans of the way the active window is represented: its icon gets a slightly longer line beneath it, but that's very hard to notice.

Windows installation to a fresh state using the installed system files. It remains to be seen whether this type of restoration will also get rid of preinstalled "crapware"; we're keeping our fingers crossed.

NEW SOUNDS AND SOUND CONTROL

A new set of system sounds

adds to Windows 10's distinct identity, and it's supported by a new finger-friendly volume widget that drags left and right rather than up and down.

WINDOWS DEFENDER COMES ON BOARD

Windows Defender has always had a slightly awkward

relationship with Windows, not being exactly a standalone application but nor being fully integrated into the OS. In Windows 10, its basic controls have been brought into the main Settings app, making it feel like a more coherent part of the system.

SHRINKABLE CORTANA BUTTON

By default, the Cortana search field takes up a good few inches of the taskbar. If your screen is small – or if you just want it out of the way – you can shrink this field to a single icon, or hide it altogether. Even when it isn't visible, you can search by hitting the Windows key and typing.

MOBILE – AND MORE

MEET WINDOWS 10 MOBILE

Windows Phone is no more; Microsoft's new OS for phones is called "Windows 10 Mobile". Technically, it's very different to the desktop OS: it's designed for a hand-sized interface, and runs on ARM hardware rather than x86. But the name change emphasises the fact that, with the advent of Universal apps, the whole Windows family now works together.

INTEGRATION WITH DESKTOP

Windows 10 Mobile is all about integration. It introduces Skype as the standard messaging client, for easy synchronisation between phone and desktop, and Edge as the system browser. It syncs notifications with your desktop PC, and it looks more like the desktop too; for example, your wallpaper now shows behind the whole homescreen.

TAP-TO-PAY AND TAP-TO-PAIR

Windows 10 Mobile introduces a feature called Host Card Emulation, which should enable tap-to-pay support at a wide range of merchants, similar to what's already offered by Apple and Samsung. There will also be



a "tap-to-pair" feature, making it extremely simple to get two Windows 10 devices to connect via Wi-Fi, or to activate screen mirroring over Miracast.

WHO GETS IT?

Similar to what's planned for the desktop, Microsoft plans to roll out Windows 10 as a free upgrade for "the majority" of Lumia phones. That includes even comparatively low-end devices, such as the Lumia 520, which offers only 512MB of RAM. Don't hang out the bunting just yet, though: Microsoft has warned that not every device will support all the features of the new OS.

WHEN DOES IT ARRIVE?

There's no official launch date, but it's almost certain that Windows 10 Mobile won't arrive until some months after the desktop version. Speaking at the Microsoft Build conference, Joe Belfiore confirmed that "phone builds have not been as far along as our PC builds. We're adapting the phone experiences later than we're adding the PC experiences."

BUT FOR THOSE WHO CAN'T WAIT...

Microsoft has launched an Insider Programme for Lumia users wanting to test pre-release OS builds; 33 handsets are supported. Proceed with caution: the download page reminds testers that the update "could cause your phone to stop

working permanently". You can wipe the preview OS and return to Windows Phone 8.1 via the Windows Phone Recovery Tool.

SURFACE HUB

The Surface Hub is an 84in, 4K interactive whiteboard, designed specifically for Windows 10. It works as a Skype-based conferencing station, a collaborative brainstorming tool and a presentation display all in one. Don't expect to see the Surface Hub until 2016, though – and don't bank on buying one for your bedroom; the huge screen means it's likely to cost upwards of 15,000.

WINDOWS 10 FOR RASPBERRY PI

A \$60 development board might seem underpowered for Windows 10 – but Microsoft has announced a special edition of Windows for such platforms, dubbed Windows 10 IoT Core. The idea is to help enthusiasts use Windows to develop "maker"-type projects for the Raspberry Pi, Arduino, MinnowBoard MAX, Hackster.io and other ultra-low-power boards.

WINDOWS 10 ON NON-LUMIA PHONES?

Microsoft hasn't said that Windows 10 Mobile will run on third-party phones, but it has been working with Chinese manufacturer Xiaomi on an experimental Windows 10 ROM that can be flashed onto an Android phone. That might

mean Microsoft wants to make it easy for phone manufacturers to install its OS onto existing hardware.

WINDOWS 10, MEET XBOX ONE

Microsoft's games console also has a big part to play in the Windows 10 vision. A future update to the Xbox One will give it the ability to run Universal apps – so you'll be able to play the same games on the big screen as on your phone and tablet, and run other entertainment apps. No firm date has been set, but the update is expected by the end of the year.

XBOX STREAMING AND CROSS-PLAY

For those who prefer to play on the small screen, Windows 10's new Xbox app supports game streaming from the Xbox One – so you can load up a disc in the front room, then play it on your tablet or desktop. In games that run on both Xbox and Windows, players on different platforms will for the first time be able to compete against one another online.

GAME DVR

One final new feature in the Windows 10 Xbox app is "Game DVR", which lets you record and share footage of your own gameplay. This means that if you pull off an amazing stunt, or a flawless victory, you can capture the last 30 seconds of play and share it with the world.

THE LITTLE BITS

A MORE TALKATIVE START MENU

We've yet to see this in action, but alongside Spotlight, Microsoft has also indicated that the Start menu might offer suggestions for apps you haven't tried, or content you might be interested in. It's all part of the vision of more interactive devices.

FLASH IN THE PAN

Windows 10 doesn't stop you from running Adobe Flash if you wish, but the Edge browser offers a global toggle that you can use to disable the plugin.

HOW MANY EDITIONS?

Windows XP came in Home and Professional editions; Vista

upped the stakes to six major versions. For Windows 10, we're back to two mainstream desktop editions: Windows 10 Home, which includes all the standard features, and Windows 10 Pro, with extra management and security features. There will also be Enterprise and Education editions designed to serve

specific markets, as well as the Mobile and IoT Core editions for different hardware types.

CONTINUUM

Continuum is a fancy name for a simple concept: Windows 10 devices can switch automatically into Tablet mode and back based on what hardware is connected.

AND FINALLY

NEW THREE-FINGER GESTURES

For touchpad users, Windows 10 introduces a range of new three-finger swipe gestures. Swiping upwards with three fingers from the desktop brings up the Task View; swiping to the left or right with three fingers lets you switch between virtual desktops. If you've used OS X's Exposé and Spaces features then – not to put too fine a point on it – you'll be right at home.

DIRECTX 12 AND WDDM 2

Microsoft's gaming API hasn't had a full version update in five years, but Windows 10 introduces DirectX 12, as well as a new edition of the Windows Device Driver Model that allows developers to take more control and reduces CPU load. Together, the two technologies promise dramatically better 3D performance on low-power hardware.

CODECS GALORE

Audiophiles and video enthusiasts can celebrate: Windows 10 includes native support for FLAC lossless audio and Matroska video, so there's no need to mess around with third-party codecs. FLAC was released in 2001, and the Matroska project was started in 2002, so it's a case of better late than never. What's in a name? It's well known that Cortana is named after a character from the Halo game series; what you might not know is that Windows 10's working codename was

Threshold, after a planet in the same universe. The Edge browser's working title "Project Spartan" is another reference to the game series, in which elite space soldiers are known as Spartans.

PREDICTIVE TEXT

Borrowing a leaf from the old Windows Phone book, the onscreen keyboard in Windows 10 features predictive suggestions that pop up along the top of the window as you type. For those working on fiddly smaller keyboards, we can see this being a hugely popular addition.

CARRIER PAYMENTS FOR ALL

To help make a success of the Windows Store, the company has been working with mobile operators to allow customers to buy apps and in-app purchases through their phone bills, rather than needing to register a credit card. That might not seem like a big deal to us Westerners, but if it helps Microsoft gain a foothold in countries where credit cards are less ubiquitous, the effects could be global.

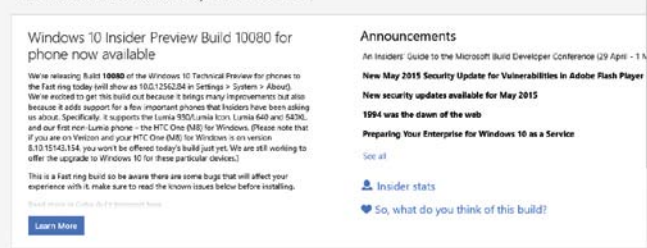
GET SET FOR ONEGET

Applications can be installed and removed in the familiar way in Windows 10, but the new OS also introduces a PowerShell-based package manager called OneGet, which enables system administrators to write scripts that locate, download and install desktop software from an online repository. It's a capability that Linux has had for decades; now Windows managers can greatly speed up and simplify software rollouts. The technology can be retrofitted onto Windows 7 and 8 clients too.

THE INSIDER HUB

Windows 10 Insiders don't just get access to preview builds of the OS; they also get a dedicated app, called the Insider Hub, sharing news and feedback about the latest developments. To encourage testers to put the OS through its paces, Microsoft

Welcome back, Insider!



has engaged in "gamification": Insiders can unlock achievement badges for trying out various features of the OS, and there are simple "quests" to be completed too, such as trying out screen-snapping and using new touchpad gestures.

SAVING SPACE ON COMPACT TABLETS

Windows 8 wasn't originally designed for compact tablets – that's what Windows RT was supposed to be for. Windows 10, on the other hand, adapts itself automatically to smaller screens. On a device with an 8in or smaller display, Start menu tiles are drawn larger, while items such as the File Explorer and Settings are moved away behind a menu to minimise clutter. There's also a system-wide "back" button, as found in Android, to help you navigate between open windows.

IS YOUR DEVICE HEALTHY?

A new security feature in Windows 10 monitors the "health" of your PC, and can even prevent you from accessing applications and websites from a system that doesn't meet a certain security standard – for example, one without up-to-date antivirus provision, or without current Windows Updates installed. It's principally aimed at businesses seeking to enforce a security policy. As with OneGet, it will be possible to install the feature on older clients too.

GOODBYE PATCH TUESDAY

As part of Microsoft's move to "Windows-as-a-service", the company has formally announced an end to Patch Tuesday. Consumer devices

running Windows 10 will get system updates as soon as they become available – and thanks to the increasingly modular design of the OS, it should only rarely be necessary to restart Windows in order to install them.

THREE BRANCHES

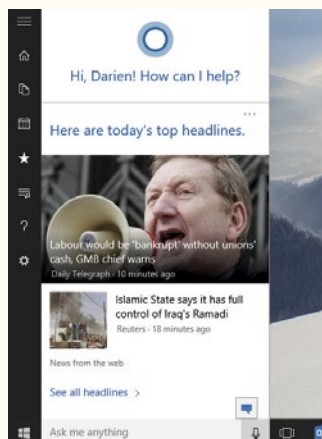
Constant updates may be fine for individuals, but businesses won't want their OS platform to keep changing. Taking a leaf from Ubuntu's book, Microsoft plans to create "long-term support" (LTS) business builds of Windows 10, which will receive only critical updates and otherwise remain stable for ten years. It will also offer a "Current Branch for Business" option, which will allow administrators to decide whether to roll out new features, or whether to hold them back.

TIPPING THE SCALE

Windows 10 lets you set display scaling on a per-screen basis – so you can hook up your compact laptop to a 4K desktop screen, drag windows back and forth between the two, and get the best image quality from both. Sadly, this doesn't mean scaling problems will vanish entirely – that requires software developers to ensure their applications scale properly. But it's a step in the right direction.

RIP MEDIA CENTER

Finally, a piece of sad news: Microsoft has confirmed that the much-loved Media Center application, already a mere optional extra in Windows 8, will disappear altogether in Windows 10. Presumably we're supposed to use Xbox One or smart TV hardware instead, but that will be scant consolation to the Media Center faithful. DVDs will still be playable, thankfully. ●



SAMSUNG PORTABLE SSD T1

*Fast and reliable data access
in the palm of your hand.*

Portable data storage very much has a place in the modern tech world, yet typical flash drives lack the speed and storage capacity that we have been enjoying with internal Solid State Drives (SSDs). Samsung has an external drive solution that combines zippy performance, generous capacity and sleek design.

FAST READ/WRITE PERFORMANCE

The Samsung Portable SSD T1 external drive is a speedy storage solution out of the box. Its USB 3.0 compatibility means sequential read/write speeds of up to 450MB/s*, care of TurboWrite Technology and enhanced data transfer speeds with UASP.

The T1 external drive is designed specifically for Windows and Mac operating systems (Windows 7 or higher and Mac 10.7 or higher recommended), with a default exFAT file system for read/write functionality across platforms.

In lay terms it means superbly fast

access to files and an external-storage solution that responds like an internal SSD.

SAFE AND SECURE DATA

There's no point worrying about the safety of your data when using an external drive. The user-friendly software wizard on the Samsung Portable SSD T1 offers the option to enable password-protected access. With password protection disabled, the T1 can be seamlessly used with compatible non-PC devices that support USB. With password protection enabled, AES 256-bit hardware encryption kicks in to block unauthorised access.

Designed also to physically protect your files, the T1's lack of moving parts makes it extremely durable as it exhibits significant resistance to impact shock. This means the T1 is safe to use in a range of different environments, with a limited three-year warranty for additional peace of mind.

PORTABLE AND STYLISH

The T1 is lightweight and portable which means that it can be practically stored in a bag, slotted into a wallet, or quite literally slipped into a pocket, offering the portability of a flash drive with the capacity and speed usually reserved for internal SSD.

The slim, compact design is just part of the appeal. With laser patterning and a black chrome finish, the T1 is as much a chic accessory as it is a piece of portable hardware. It's fashionable enough to be trendy on the outside and fast enough to deliver the goods where it matters. All

you need to do is connect the matching jet-black USB cable to a compatible device, and you're able to instantly read, write and transfer your files.

USER-FRIENDLY OPTIONS

There's no such thing as a one-size-fits-all solution when it comes to external storage. Some are looking for a medium storage option for files and pictures, others for storing raw images, and others still working with large video files. The T1 comes in 250GB, 500GB and 1TB models to suit external-storage requirements across a range of capacities.

You may not be able to depend on the consistency of an internet connection when you're out and about to access gigabytes of cloud-stored data, but you can rely on the Samsung Portable SSD T1. It has the speed and storage capacity of an SSD drive, the dependability and durability of enterprise-grade hardware, as well as the design and visual appeal that positively encourages you to take it everywhere!

LATEST TECHNOLOGY

The T1 external drive takes advantage of some pretty clever tech to deliver its portable performance and reliability. Thanks to V-NAND technology, the T1 is able to achieve higher speeds, greater endurance and boosted power efficiency, while simultaneously offering a larger storage capacity. This is achieved by evolving the traditional 2D NAND storage principles and embracing a 3D vertically stacked internal structure.

**Performance benchmark products : T1(500GB)*



SAMSUNG



PORTABLE STORAGE HAS EVOLVED

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Virtual Reality

THE TIME HAS COME

THE ONCE-BITTEN, TWICE-SHY JACK SCHOFIELD THOUGHT VR WAS PURE HYPE. HERE, HE REVEALS WHY THE VIRTUAL REVOLUTION COULD BE JUST MONTHS AWAY

It's been almost 30 years since Dr Jonathan D Waldern founded a tiny company called W Industries to develop a "virtual-reality" system - which included a head-mounted display (HMD), data gloves, a tracking system, and associated software. I still have vivid memories of trying a prototype. How could I refuse an invitation to experience the future?

Later, in 1993, the company - now called Virtuality - was floated on the London Stock Exchange. Its share value almost doubled on the first day, making Waldern a multimillionaire. By this time, the firm had marketable games such as Dactyl Nightmare, in which you battled a green dinosaur, and Grid Busters, a robot shoot-em-up. If you're of a certain age, you may have played such games in Sydney's Intensity, or the Embarcadero in San Francisco, or in similar arcade malls in the USA, England or Japan. If you'd been pre-sold VR by science fiction - such as William Gibson's *Neuromancer* - you had to have a go.

But the technology never made it further than those early games. Virtual reality crashed and burned.

BEFORE ITS TIME

The basic strategy had seemed sound: consumers would experience VR in malls and arcades, and this would encourage them to buy their

own headsets. But the games business failed to deliver. Atari planned to release a Virtuality-based headset to go with its Jaguar games console, but pulled out. Sega promoted its US\$200 Sega VR headset for the Mega Drive console at the Consumer Electronics Show (CES) in 1993, but it was never launched. At CES in 1995, Nintendo launched a monochrome VR system called Virtual Boy. It soon wished it hadn't, though: Virtual Boy flopped, and was cancelled the following year.

Virtuality then did deals with Philips and Japan's Takara to launch a US\$299 Scuba headset, which was released in 1997 and apparently sold more than 55,000 units. Impressive for a system with a 320 x 240 resolution, but as an Amazon reviewer noted: "Today, it's all too clear that Philips totally dropped the ball here and basically released a product that wasn't ready for prime time."

Did the first wave of VR arrive before its time? Yes. Is now the time? Maybe. The industry's hopes are focused on December 2016. Starship's Paul Hollywood, who has been developing VR and video-game software for decades, told me: "Christmas 2016 is going to be the first VR Christmas. You'll have the headsets on sale and there'll be a wave of content."

Whether there'll be a second VR Christmas remains to be seen, but billions of dollars are being invested in anticipation, such as the US\$2



billion that Facebook boss Mark Zuckerberg paid for Oculus VR last year. That's a chunky sum of cash for a firm that started on Kickstarter and has yet to launch a consumer product, but it reflects VR's status as the current golden child of technology.

Last year, a Sophic Capital report, "Virtual Reality: A Virtual Goldmine for Investors", suggested the VR market could be worth US\$7 billion - US\$2.3 billion in hardware and US\$4.7 billion in software - by 2018. It also predicted headset sales would grow from 200,000 to "about 39 million over five years".

Gartner research director Brian Blau has also predicted that "virtual worlds will have transitioned from the fringe to the mainstream" by 2018, and that more than

25 million HMDs will have been sold. This doesn't include phone-based headsets or non-electronic models such as Google Cardboard. Blau doesn't expect a rapid take-up because of a shortage of mainstream content, but he does expect that there will be more action in the next 18 months than in the past 18 years.

I confess to a feeling of déjà vu. Today, we have another garage-style startup that has made its founders rich, except it's called Oculus VR rather than Virtuality. And we still think gamers will kickstart sales of HMDs, only this time our hopes are pinned on the Oculus Rift, HTC Vive, and Sony's Project Morpheus, rather than console names Nintendo, Sega and Atari.

But there are two important differences this time. The first is that we have almost ubiquitous high-speed communications of the sort that didn't exist in the dial-up world of the 1990s. Today, we can stream VR data from almost anywhere in the world, rather than getting it on a games cartridge or a CD-ROM. Real-time conferencing, 3D commerce and virtual tourism are real possibilities, even if we no longer want to set up virtual homesteads in Second Life.

The second major difference is that, thanks to more than 30 years of Moore's law, we now have so much computer power that even a mobile phone can create a good VR experience.

Waldern's first system was based on the

VR KIT: WHAT'S OUT, WHAT'S COMING

WITH AROUND 18 MONTHS TO GO BEFORE CHRISTMAS 2016, NUMEROUS VR SYSTEMS ARE BEING PREPARED FOR LAUNCH. HERE'S OUR GUIDE TO THE MAIN CONTENDERS

OCULUS VR

DUE 2016 FOR "CRESCENT BAY"

LIKELY PRICE \$500-\$600

Oculus Rift has the highest profile of any VR system, thanks to its \$2.4 million Kickstarter - and the small matter of Facebook buying the company for \$2 billion. It's currently supplying US\$350 Rift headsets with Development Kit 2 (DK2). The latest prototype, codenamed Crescent Bay, was a hot demo at the Game Developers Conference (GDC) in March, but it seems many developers are still waiting for samples of the kit.

Starship's Paul Hollywood, who's been developing VR software for decades, said he "had a go at Crescent Bay" at a VR developers' conference in LA and "came out of the demo like a child, jumping up and down. It blew me away."

The Crescent Bay headset has two screens - one for each eye - and is connected to a powerful computer by video and USB cables. The PC knows what you're doing because a small positioning camera, much like a webcam, picks up signals from infrared LEDs mounted on the headset (think Wii controllers). The headset also features an



"Adjacent Reality Tracker" (ART), which includes a magnetometer, a gyroscope and an accelerometer. The ART captures even small head movements.

Oculus VR has a classical idea of immersive VR, ripe for gaming. According to chief executive Brendan Iribe, Crescent Bay "allows for sustained presence - for you to achieve

the impossible and believe you're in another world". Facebook boss Mark Zuckerberg seems to think of it more as a social platform, but a Facebook Live (à la Xbox Live) service could cover all bases.

Oculus VR hasn't confirmed details of the launch, but we do know it plans to have pre-orders open at the end of this year, with a shipping deadline of Q1 2016. It will require a higher-end PC to run, with the total package coming to around \$2,000, according to Iribe.

SAMSUNG GEAR VR

DUE ON SALE NOW

PRICE \$200

Samsung is already offering the Oculus-based Gear VR system, where the two virtual screens are provided by a single 5.7in Galaxy Note 4's 2,560 x 1,440 display. (Oculus used a Galaxy Note 3 screen for its Rift DK2.) A newer version of the Gear VR uses a Galaxy S6 smartphone, with a Note 5 version predicted for release later this year.

Since the smartphone drives the display, users aren't tethered to a PC. The Gear VR lacks a positional tracking system, and you control its menu system by tapping the side of the headset. There are some games, but the system is also being used to view movies - Samsung offers a Milk VR movie service in the US. Then there's the promise of virtual tourism and even a virtual cookery course, in the form of Starship's CyberCook. Either way, all the developers I talked to rate the Gear VR very highly.



Commodore Amiga, which had sophisticated graphics chips but limited resolution, to say the least: if your eyesight was that bad, you'd be legally blind. Today's VR systems are a world apart. In terms of games, it's somewhat like comparing id Software's original *Wolfenstein 3D* (1992) with *Wolfenstein: The New Order* (2014).

There is, of course, another point to this comparison. In August 2013, id co-founder John Carmack, the father of first-person shooters, joined Oculus as chief technology officer. He's worked on both the Oculus Rift and the related Samsung Gear VR, and to quote VR evangelist Dan Page from *Opposable Games*: "if John Carmack's got something to do with it, it's going to be good."

The guy's a wizard."

More new systems could appear, but at present it looks like Christmas 2016 will be a straight fight between the Oculus Rift and HTC Vive, with Morpheus picking up PS4 users. Oculus VR has Facebook money, but the HTC Vive could get a head start if it launches this year. Ordinary consumers could go for Samsung's Gear VR as a relatively painless way to explore VR – the catch being that the cheapish headset requires an expensive Samsung phone.

GAMES AND AFTER

Oculus Rift, HTC Vive and Sony Morpheus are all targeted at gamers, because gamers are the most visible market for VR. This is both

a blessing and a curse for a technology that wants to take over, or replace, the world. "I expect VR to be huge hit with PC gamers, but that's a niche," said Page. "Reaching everyone who owns a high-powered PC isn't going to be seen by some people as a mainstream success. And there are so many other uses for VR in engineering, medical applications, training, experiential marketing and all sorts of fields."

It may also be harder than some expect to crack the gaming market. Many games are already interactive and in 3D, so the transition looks easy. "That may be naive," said Gartner's Blau. "You're taking a keyboard and mouse and changing to some other kind of controller, and we don't even know what that controller is yet. The UI was made for



HTC VIVE

DUE NOVEMBER 2015

LIKELY PRICE \$400

Valve, an established games software company, recently unveiled its Vive VR headset, produced in conjunction with Taiwanese phone manufacturer HTC. The Developer Edition headset has two 1,200 x 1,080 displays, which HTC says can deliver "photorealistic imagery".

Like the Oculus Rift, it's fed by a PC. It also uses two small Lighthouse laser-tracking base stations for high-precision room mapping and location tracking, so the user can move in a space up to 15ft square. It uses "context-aware" SteamVR handheld controllers, which you can see as hands (or anything else) in your virtual world. VR applications will be distributed via SteamVR.

Many of the people who tried Vive at Mobile World Congress or GDC 2015 raved about it, and it seems to be a significant advance on Oculus Rift DK2. Dan Page from *Opposable Games* wrote a blog post about it: "We've tried the HTC Vive and it's absolutely mind-blowing." Visit pcpro.link/250vive.

Oculus has the recognisable brand, but Valve may have a better system, plus more than 125 million game-playing customers. The Vive VR could go on sale this November.



RAZER OSVR

DUE 2016

LIKELY PRICE UNDER \$400

Razer, a games hardware company best known for its mice and keyboards, has developed an open-source virtual-reality headset known, obviously, as OSVR. Both the hardware and software are open source, so this could be a quick route to market for third parties if VR actually takes off. In that sense, OSVR is a bit like Android.

Razer plans to ship a US\$200 Hacker Dev Kit this summer, and claims developers will be able to use it to develop software for other VR systems as well. It will support the main game engines, including Unity 3D, Unreal Engine 4 and HeroEngine.



SONY PROJECT MORPHEUS

DUE 2016

LIKELY PRICE \$400-\$500

Sony plans to enter the VR market with Project Morpheus, which uses a PlayStation 4 games console to drive the display.

The latest Morpheus headset has nine LEDs, which provide location information via a PlayStation Camera. For its GDC 2015 demos, Sony used an extra box linked to the PS4 to drive the headset, but it's not clear whether this will be part of the final system.

Either way, Morpheus is due to appear in the first half of 2016.



MICROSOFT HOLOLENS

DUE UNKNOWN

LIKELY PRICE \$800+

While Microsoft doesn't plan to enter the VR market, at least as far as we know, earlier this year it revealed an "augmented-reality" (AR) headset called HoloLens. This doesn't take you into a virtual world, but adds graphical objects to your existing reality. Of course, you can end up in a VR world if the augmentations obscure the real world. For example, an app that Microsoft developed with NASA enables space scientists to walk around a simulation of the surface of Mars. The HoloLens headset is self-contained and, if it ever appears, will be driven by a built-in PC running Windows 10. Hypothetically, Microsoft could also provide location tracking via Kinect. However, the HoloLens that Microsoft showed in January looked like a prototype, and again, I'd bet against a commercial version appearing this year.

GOOGLE GLASS "VERSION TWO"

DUE UNKNOWN

LIKELY PRICE UNKNOWN

Google has already had a go at augmented reality with its Google Glass project, which wasn't a huge success. Reports suggest that it's working on version two in partnership with traditional glasses makers. In April, the chief executive of Luxottica – the biggest eyewear manufacturer in the world – told investors that version two of Google Glass will be coming soon, while hinting that it's all leading up to "version three".

Google has also launched Google Cardboard, which is a cheap and cheerful way of turning almost any smartphone into a VR headset.

“We’re just starting to scratch the surface of the true power of virtual reality. It’s not a video-game peripheral. It connects humans to humans in a way I’ve never seen before”

2D, even though the game worlds are 3D, and that may not make the leap either. If it’s not a good experience, people aren’t going to buy: it doesn’t matter how good the hardware is.”

As Dan Page says, the problem isn’t creating a virtual-reality experience, it’s creating a good virtual-reality experience. That was something Virtuality and others learned in the early 1990s: you can blow people’s socks off with a short demo, but it’s much harder to develop a game they’ll want to play every day.

Unfortunately, even with all the technical improvements, VR still has limitations. One is the feeling of nausea or motion sickness caused by what AMD’s LiquidVR spokesperson calls “motion-to-photon latency”. This is caused by a delay between you moving your head and the scene updating. You may also feel disorientated if the scene changes rapidly but you haven’t moved your body. “A roller-coaster simulation can make you feel terrible because you’re sitting still,” said Starship’s Hollywood. “You need something like a cockpit to give you a reference point so you can have movement going on around you.”

These are the sorts of things VR game developers have to worry about: they don’t want to make too many people sick.

A WIDER AUDIENCE

Developers in other areas are hoping gamers will popularise VR, and thus make headsets widely available. For example, Plextek Consulting’s Collette Johnson is working on a medical training system which has specified Oculus Rift for training soldiers on a virtual battlefield. “The gamers will drive [adoption],” she said. “We want them to drive it, because they’ll buy big numbers and normalise VR for a wider market.”

Hugo Pickford-Wardle, chief innovation officer at Matter, takes a similar view. He sees gamers as early adopters of cutting-edge technologies. When they buy headsets, “it makes VR available to the rest of the family, where people can use it as a Skype alternative or for shopping in a virtual mall,” he said. “It’s almost a trojan horse.”

In the short term, the Samsung Gear VR may turn out to be an effective trojan horse. “You can take it down to the pub, pass it



▲ Sony’s Project Morpheus headset works with the PS4 console

➤ Facebook’s US\$2bn acquisition of Oculus points to the potential size of the VR market



around and show very high-resolution, very low-latency VR to people without having to lug a big PC around,” said Opposable Games’ Dan Page. “The 360-degree movie content is a really easy way to show people just how special VR can be.”

FIRST CLASS VR

Samsung is certainly trying to bring Gear VR experiences to a wider (and more upmarket) audience. For example, in a three-month trial with Qantas, Samsung is providing headsets in First Class lounges in Sydney and Melbourne airports and “in the First Class cabins on select A380 services”. Passengers will be able to watch movies on the headsets, and enjoy “VR experiences”. Expect more companies to try this sort of thing while it has PR value.

Samsung also used Gear VR headsets at the World Economic Forum in Davos to show “more than 130 global leaders and dignitaries” a UN-backed film directed by Chris Milk about a 12-year-old girl living in a Syrian refugee camp in Jordan. Milk showed clips from the film in a TED talk titled “How virtual reality can create the ultimate empathy machine”. In that, he said: “We’re

just [starting] to scratch the surface of the true power of virtual reality. It’s not a video-game peripheral. It connects humans to humans in a way I’ve never seen before.” You can view the talk at tinyurl.com/pt6jwkr.

Milk fan Simon Sparks, co-founder of immersive video producers Yoovi, thinks that 360-degree VR movies could become really popular “because they can take you somewhere you never thought possible”, whether that’s on stage at a concert, the bottom of the ocean or the surface of the moon. “They’re filmed with rigs covered in GoPro cameras – they seem to be the weapon of choice – then stitched together,” he said. (On 28 April, GoPro bought Kolor, a French company whose software allows users to stitch together photos or videos to create immersive views.)

But as an AMD spokesperson reminded us, capturing an immersive audiovisual experience is just the start. To achieve “full presence” in another environment, we also need “touch and other stimuli such as temperature, kinaesthetic sense and balance”. But since VR headsets have yet to take off, it may be too soon to start thinking about VR body suits. ●

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COMPUTEX 2015

BEN MANSILL AND BENNETT RING RETURN FROM THE BIG ANNUAL COMPUTER SHOW IN TAIPEI WITH TALES OF GREAT THINGS SEEN...

What dazzling and hopefully surprising revelations were to be revealed at Computex 2015? A week after returning from the show that consumes Taipei, we can safely say that the world of PC components and peripherals is as innovative and wide-ranging as ever. Let's look at some of the highlights.

The day before the main show starts, Asus traditionally grabs the limelight with its annual mega event. This year saw just four products launched on the main stage, several fewer than last year, but not the full suite of Asus 2015 gear announced at the show.

Asus would have been thrilled with the turnout, the attendees less so as with least twice the room's capacity trying to squeeze in, and before the due starting time. This turns out to have been overshot and when the event finally started the media sardines were ten-deep along the edges of the room and many more trying to peer in from outside the door - having failed to navigate the chaotic registration process.

Also maddening, the slides had most of the writing on the bottom half, so only the first few rows could actually see what was being displayed.

There's no denying Asus likes a big buzz, and it's a truth that every year the many new products generally impress. CEO Jerry Shen was big on lifestyle, with many bold catchphrases adorning the event, like "luxury on your terms", "human centric curves" and "narcissistic beautification modes." Yes, they really said that.

The well-specced Zen AIO PC 2401C & Z2201C desktop PC sports an i7 and a 4x PCIe SSD storage, also USB 3.1 and Intel's Real Sense too. All up a nice refresh of the AIO space with the latest tech.

The PA329Q ProArt 4k monitor is the latest iteration of the always impressively-specced and well priced ProArt series, with 100% Adobe colour, 16-bit look up table all in a 3840x2160, 32inch chassis.

ZENFONE SELFIE

Groan. But, inevitable, and props to Asus for cornering that valuable moniker. There was five minutes about how it's not humanly possible to remember memories unless they're captured and stored on an Asus device. "Human-centric curves" were highlighted. The actual selfie business comes via 13MP front and back cameras, dual LED flash plus laser autofocus. "Narcissistic" beautification modes that also allow "whitening" were also touted to the international audience. "Like wearing digital makeup" and "like having a personal spotlight everywhere I go" said the glamorous presenter. Low light selfie modes are there too.

"Luxury on your terms" was the catch phrase for the ZenPad 8.0 tablets, whatever that means. They're styled to look like a ladies clutch, we were told, but it looks like a regular tablet to us. There's a bunch of new image fudging features, boosting contrast and sharpness. Asus also claim the "world's first surround sound for tablets" with 6 speakers. An Atom X3 CPU powers the party.



▲ MSI's mighty GT80 sports a mechanical keyboard along with a top-end GTX980M GPU

The optional Power Case adds 15hrs of extended battery life.

GIGABYTE

While Intel's Skylake CPU isn't due until around August, Gigabyte is ready with a healthy range of new 100-series gaming motherboards. They feature the 170-series variant, which for now will be the performance variant of the chipset. The new white headshields look fantastic and is a refreshing new look.

Of particular note is the latest Killer X3 chip, which allows both Ethernet ports to be used simultaneously in a sort of LAN-RAID configuration. You can manually select apps per channel (say, Skype on one, Torrenting on another), or even enable the Wi-Fi for a triple-speed setup. The system allows either manual or automatic configuration.

Audio got a boost, too, with Creative's Sound Blaster Core 3D chip delivering a very impressive 120 db output. It also has a quality Burr Brown DAC, thus pretty much negating the need for a discrete audio card for anyone but audiophiles.

Another very interesting feature we were shown by Gigabyte on the new Gaming G1 board was a dedicated chip that controls the CPU BCLK setting. It bypasses Intel's hard limits and adds linear granularity and expanding the range. Gigabyte told us to expect access to any BCLK between 90 and

✓ Corsair's Lapdog allows keyboard and mouse gaming from the lounge





▲ CLOCKWISE FROM TOP LEFT: Gigabyte's G1 Gaming motherboard, the very many new and updated Gigabyte laptops on display, Galaxy VR in action, a Gigabyte demo workstation system, Asus is getting into home automation and this is the Wi-Fi base station, the new Asus VivoWatch which uses a unique Koodos operating system

200 on the new boards, with every possible BCLK in between selectable!

The G1 Gaming looked the business. Gigabyte has added metal strips across the top of the PCIe plastic slots for durability (and looks!). The chunky white heatsinks look fresh, and it's water-ready with threaded fittings for the components around the CPU.

Interestingly, Gigabyte introduced a unique U.2 to M.2 adaptor. This allows the use of SSD's built to Intel's new NVMe SSD standard (see our review on page 45) to be attached to the motherboard's M.2 slot, thus using its PCIe Gen. 3 x4 lanes, but in a way that guarantees compatibility with any motherboard with an M.2 slot.

While the star of the show was the fully-featured G1 Gaming board, look out for the full range of 100-series boards from Gigabyte, covering the Z170 range, including mATX and mini-ITX boards, as well as H170, Q170, H110 and B150 boards. The new features being introduced in the 100-series boards vary per board, with the high-end Z170X Gaming G1 boards (Gigabyte will have five boards in this particular line-up) featuring almost all of the new techs, including USB Type-C, the linear BCLK controller as well as two M.2 slots.

The company also showed off a huge range of gaming and otherwise outrageously powerful laptops, including the high end X7 which has an SLI

configuration of two GTX 970M GPUs pumping graphics to a 17inch G-Sync screen.

Across the rest of the Gigabyte laptop range most of last year's models have been updated to use Broadwell CPUs and GTX 970M graphics.

MSI

MSI is on a gaming laptop roll and its new range was debuted at this year's Computex show, leaving no doubt that the company is on a mission to dominate this sector.

The King of the hill is the monstrous GT80 Titan. This desktop-sped machine boasts an Nvidia GTX 980M GPU, the fastest mobile GPU currently available, and that's backed up by a proper i7 CPU and all in a big big 18.4inch screen.

What's more, the GT80 has a mechanical keyboard with full RGB lighting. It's quite easily the most complete gaming laptop we've seen and should be very tempting as a desktop alternative for hardcore gamers.

An interesting alternative to the GT80 is MSI's also-new GT72. This also sports the 980M GPU but adds in Nvidia's G-Sync technology for buttery frames when gaming on the laptop. The GPU is backed up by a hefty 8GB of GDDR3 graphics memory.

Not much of a gamer? MSI's Prestige series could be interesting for casual games, with a GTX 950M or 960M GPU, in 15.6inch or 17.3inch versions and they look very classy in a slick silver finish.

MSI is big on its Nahimic audio, which is licensed from a French company that originally developed the technology for military application. Besides a range of EQ presets, the software equalises mic and game audio, putting an end to volume balancing gamers face.

We also tried out the new eye tracking system, which adds three cameras between the bottom of the screen and the keyboard. It follows the gamer's pupil movement and we played a bit of Witcher 3 where you can look around the game world and steer the character as he walks. It was surprisingly accurate and offers a tangible in-game advantage, but mostly is simply huge fun to get into.

MSI is on the right track here. Yes, it's building machines as powerful as is possible with today's CPU and GPU technology, but is going a step further with genuinely innovative ideas that make a big difference to the whole experience for gamers.

ELSEWHERE...

Galaxy, a company mainly known for superbly engineered graphics cards, showed the Galaxy VR headset. The company claims it was developed internally and uses no licensed technology. At this stage the specs match the Oculus DK2 and it is intended for

▼ The new Synology DS215+





▲ Corsair's Bulldog, from the outside of its unique case, and inside the puppy's guts



development for now.

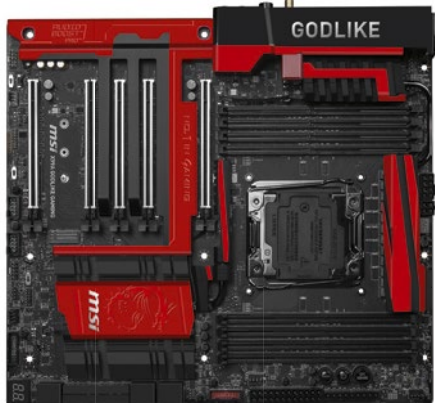
Asus is getting into home automation, with a range of Wi-Fi gear including a magnetic door lock. Asus also has a smartwatch, the VivoWatch, but unusually it eschews Android Wear and features its own Koodos OS, which claims 1-2 days better battery performance than Android Wear.

Synology has again shown that it is so far ahead of the competition with its software that it shames the others. The Diskstation Manager is incredibly deep yet brilliantly easy to use, joyful, even. Two new consumer 2-bay NAS products were also launched, the DS215+ and DS715, the latter of which sports a better CPU (both run Apine processors from Annapurna Labs).

I saw truly the nicest case I've ever set eyes upon at Antec. The Signature Series S10 is classy and engineered with detail and cleverness. There's a split gap that runs down the entire height, separating the front drive area from the components to keep things cool. It's manufactured supremely well. For now we don't get the ultra sexy version with red accents. It won't be cheap, at US\$400. Local pricing is not available at this time.

Asrock and MSI also had 100-series motherboards on display, which was a bit of a surprise, seeing as Intel's Skylake CPU isn't due until at least August. The boards, and there were many variations, support both DDR3 and DDR4. We can be sure that there will be ready inventory when Intel's highly anticipated CPU arrives. All on display were

▼ MSI deifies its motherboards with a fairly clear statement of gaming superiority



the initial Z170 variant of the new chipset for performance systems.

MSI also had a new gaming motherboard, the 'Godlike'. Yep, really. MSI also talked up its use of Nahamic audio which has many EQ settings and also works well with microphones by cutting background noise and equalising all channels.

Cooler Master made a huge impression with its new Maker series, which spans cases, headphones, mice and more. The whole idea is customisability, with the case being modular, and various bits can be ordered and modded. The headphones have interchangeable speaker modules, one for music, one for gaming. This will go far.

BUDGET SSD'S BLAZE AHEAD

Things certainly change quickly. OCZ announced its new Trion SSD series, intended for budget buyers. But the thing has a potential bandwidth of up to 550MB/s and up to 91,000 reads lifetime. Stats like that put it in the performance category and it comes thanks to using new TLC NAND flash. It's great to see OCZ back from its bad place a few years ago, and with parent company Toshiba fuelling many excellent products from OCZ.

CORSAIR

In a show filled with me-too cases and motherboard clones, Corsair's major new product announcement was refreshing to say the least. Unveiled at its big media party the night before the show kicked off was Bulldog, Corsair's attempt to bring 4K gaming to the living room.

It's basically a barebones gaming PC, but Corsair has delivered several key new innovations that make this a truly game-ready machine for your living room. Firstly there's the weird case design. It's just small enough to fit inside a standard rack in your AV cupboard, but you must use the cute little doggy legs to keep it lifted off the shelf. This helps air flow below the case, which is crucial for cooling this little pup's innards. We're a little torn on the aesthetic of the case, looking something like a robotic pugdog that has been decapitated.

Heading inside the case reveals a powerful 600W power supply built to a very small size, giving this machine the oomph



▲ The Bulldog comes with a CPU water cooler as well as a GPU block (shown)

necessary to run a high-end i7 CPU and GTX 980 Ti or Titan X. There's room for a full length graphics card, which can be water cooled courtesy of Corsair's new HG10 water cooling adaptor, which allows you to fit a Corsair CPU cooler to any reference GTX 9XX series card. MSI will also be releasing graphics cards with this solution in place, including the CPU cooler. Another water cooler - this time included in the price - takes care of the CPU's heat. Total audio output is rated at 30dB or less, depending on what you squeeze inside. Most remarkable of all is the price though; at just US\$399 it includes the case, PSU, CPU cooler AND a Mini-ITX motherboard. Corsair hasn't determined which mobo it'll go for though, but regardless it's an absolute steal. We're not sure it's quite up to 4K performance though, unless you whack in a pricey GTX 980 Ti. Corsair plans to set the Bulldog free at the end of the year.

Corsair's other killer product is designed to go hand in hand with Bulldog. The Lapdog is a lap-mount for your keyboard and mouse, allowing precision gaming from the couch, which is where the Bulldog will likely be used from. We found it a little heavy for our liking, with a smallish mousepad, but it's still in prototype stage. Hopefully Corsair can trim off the fat at the top, used to hide the cables, while also equipping it with a wrist-rest and larger mouse pad. Expect this to land in Q4 of the year, with a price of US\$89.

▼ Thermaltake's Theron Plus+ is smart, it can track your on-screen activity





THERMALTAKE

Unlike last year's focus on water cooling, which didn't seem to eventuate in the real world, this year Thermaltake aimed our attention at its highly successful range of keyboards and mice. Along with the usual budget models (one of which offered a mouse and keyboard for just AU\$29!), it had a couple of cool new technologies to help differentiate them from the pack.

The first was a keyboard and mouse combo equipped with Bluetooth modules, but it's not for wireless control. Nope, the Poseidon Z Plus Smart and Theron Plus Smart instead use this radio chip to beam data about your actions to the special application. It measures actions per minute, mouse movement per minute and a few other details to the app, which can then be shared online. While this might seem a little gimmicky, professional gamers will find this data to be extremely useful.

We also loved the Poseidon Z Touchbar, which has the cleverest space bar we've ever seen. It's not your usual thumb-basher, instead being equipped with capacitive sensors that break the space bar into up to five configurable zones. Each zone can then

be mapped to a different key or macro. For example, the left two thirds could be set to jump, while the other three are used to crouch. It'll be interesting to see whether our dumb thumbs will be able to differentiate between these sections though, but we'll find out at the end of the year when this key keyboard is released.

ASROCK

ASRock might be better known for its motherboards, yet it was the company's new G10 gaming router that blew us away. This is the first consumer router to market with a 4T4R (four transmitters, four receiver) configuration, which delivers the fastest performance ever seen in a Wi-Fi router. A single device can receive up to 1733Mbps in bandwidth, surpassing Gigabit Ethernet. However, the fact that there are no 4T4R adaptors for PCs means it'll be some time before users can make the most of this router's speed. A detachable HDMI dongle is also included, which can be used to stream a wireless HDMI signal, or be plugged into an existing network to operate as a travel Access Point. Sadly it won't work as a Wi-Fi dongle though. Expect this 802.11a/b/g/n/ac

- 1 Cooler Master's Maker headphones have swappable driver units
- 2 Three of Acer's X34 gaming monitors (due here around Q4)
- 3 Asrock's rather stunning new G10 gaming router
- 4 Product demonstration hostesses
- 5 OCZ's Zoe shows off the new Trion SSD series
- 6 One of MSI's impressive modded PCs
- 7 Cooler Master's Maker series case options

router to go on sale at the end of July with a remarkably low price of US\$250.

KINGSTON

Kingston's big push for the upcoming year is DDR4, with its Predator kit offering official support for DDR4-3000, yet should be able to be pushed to 3400MHz without too much trouble. Kingston also used the show to demo its new Cloud II gaming headsets. With tasty 53mm drivers it provides plenty of punch, and will also include a USB sound dongle with virtual 7.1 sound. We're not sure if the pink girls version is patronising or perfect. We managed to score one and it's reviewed on page 58.

IN THE LABS

You won't find better reviews anywhere in Australia!

FURY US

BEN MANSILL AND THE CONUNDRUMS OF OPPORTUNITY

Can AMD trounce Nvidia with its Fury/X video card? At the time of writing... I don't know! As I write, it is about an hour to go before we send this issue off to the printers. It's also a day since the first Fury X video card arrived in Australia and was expressed over to us for testing and the review by AMD. So, this is one of those thrilling 'hold the front page' moments in publishing. So very exciting.

Our kind production department spun some plates and gave us an extra 24 hours for the three pages that have been given to the Fury X. So, overnight, tonight, our printer is preparing 98% of the magazine and will add the three Fury pages at the last possible moment.

Meanwhile, in the PC&TA Labs Bennett has been up for most of the night testing the Fury X, and will be at it again through the next few hours. What a champ. We don't often do this, but AMD's new King Card is absolutely fascinating, so we just couldn't wait a whole month to get the word to you. A big thanks to AMD for going

out of its way to make this happen, too. With the Fury, AMD debuts High Bandwidth Memory. The huge increase in memory bandwidth, and at relatively low power compared to GDDR5, makes it a fascinating proposition. Just as 4k is becoming viable, relieving this choke point comes just in time. I saw the naked GPU yesterday and the HBM stack on the die, alongside the GPU took some getting used to, after all these years when CPU or GPU dies effectively look the same.

As technologically impressive as HBM is, putting in on-die has meant that, for now at least, AMD is physically limited with how much it can put on there. The Fury /X has 4GB, and we'll all find out very soon if that relatively low amount actually matters if the card's memory performance is so high.

OVER AT THE 'LOG

The late and unplanned arrival of the Fury X may, or may not, invalidate this month's Kitlog, where we have just added (among

many other tweaks this month) Gigabyte's fabulous 980 Ti. As it stands, right this second, the Gigabyte is indeed the best card for the Perfect PC build - but will the Fury X be a better proposition? That, friends, will have to wait until next issue. We won't have the Fury X results in time to make any changes to Kitlog now, so with bubbling excitement we shall review the card in the Perfect PC next month.

EXTENDERS!

In rather more mundane news, yes, we have finally put together a group test of Wi-Fi extenders! I've had many requests for this from readers, so it's great to actually tackle this very useful roundup. Sure, we review the latest routers all the time and if you are happy with your router performance, but not the distance it works well at, then for a good price an extender can deliver the goods to the entire home or office.

See you all next month, as we digest the new state of the graphics scene!



AMD FURY X
40



PHILIPS 4K
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EDITORIAL & PRODUCT SUBMISSION: PC & Tech Authority welcomes all information on new and upgraded products and services for possible coverage within the news or reviews pages. However, we respectfully point out that the magazine is not obliged to either review or return unsolicited products. Products not picked up within six months of submission will be used or donated to charity. The Editor is always pleased to receive ideas for articles, preferably sent in outline form, with details of author's background, and - where available - samples of previously published work. We cannot, however, accept responsibility for unsolicited copy and would like to stress that it may take time for a reply to be sent out.

WHAT OUR A-LIST MEANS

Our A-List award is reserved for the best products in each category we review. With a winner and an alternative pick in each, that's 92 products you know are first class.

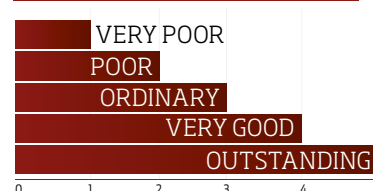


WHAT OUR AWARDS MEAN

PC & Tech Authority's comprehensive Real World testing sorts out the best products from the pack. Any product recommended by PC & Tech Authority is well above average for features, value for money and performance.



WHAT OUR RATINGS MEAN



HOW WE TEST

Our benchmarking tests are the best in the business. Read on to find how they work...

2D TESTS

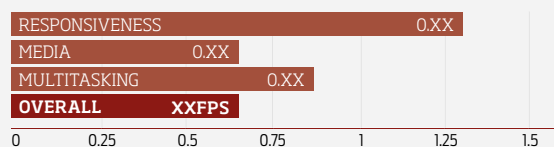
We test desktop PCs, netbooks and laptops with our own, custom-built, 2011 Real World Benchmarks.

We split the results into three categories: Responsiveness, Media and Multitasking, with the Overall score an average of the three sub-scores.

For instance, responsiveness replicates light browser and productivity workloads. The Media test involves running iTunes for audio conversion, Photoshop CS5 to crunch large images and Sony Vegas 10 to edit home video. This then gets run simultaneously alongside Cinebench 11 in order to get a handle on the multitasking ability of the system.

BENCHMARKS

3.4GHz Intel Core i7-2600K, 4GB DDR3 = 1



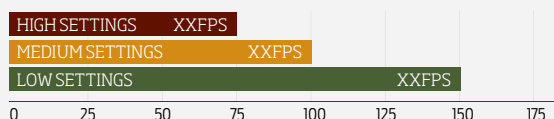
3D TESTS

We use pre-recorded demos in Crysis and DIRT 3 to test gaming performance where relevant. We have three standard test settings, depending on the power of the graphics card: Low, Medium and High.

To test gaming performance, we use our own recorded Crysis benchmark. We use the Low, Medium and High quality settings in 1366 x 768, 1600 x 900 and 1920 x 1080 screen modes respectively. Very high-end systems can also be tested using the ultra-intensive Very High settings, with all detail switched on, and varying levels of anti-aliasing enabled.

3D SPEED

■ GOOD ■ PLAYABLE ■ UNPLAYABLE



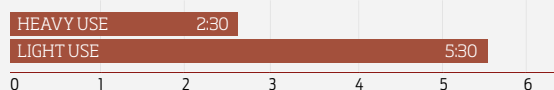
LAPTOP BATTERY LIFE

We subject laptops to two battery tests. In the light-use test, we optimise the system settings for the greatest power efficiency. We then disconnect the mains and run a script scrolling a selection of web pages until the system shuts down, giving you a realistic idea of the surfing time each laptop offers.

For the heavy-use test, we engage Windows' High Performance power profile, set the display brightness to maximum, and allow the taxing Cinebench 3D renderer to push the processor load to the limit. This gives a worst-case figure, revealing how long you can expect the battery to last under the most demanding conditions.

BATTERY LIFE

HOURS:MINUTES



REVIEWS

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AMD Radeon R9 Fury X

AMD TAKES A SWIPE AT THE TOP SPOT



Put it by the poor Titan X owners. No sooner had they splurged \$1600 on Nvidia's latest insanely over-specced graphics card than Nvidia released a barely hobbled version of it in the GTX 980 Ti. Costing 50% less with a mere 4% performance drop, GeForce GTX 980 Ti owners had, and still have, plenty to be happy about. Or do they? AMD's brand new Radeon R9 Fury X is positioning itself as a GeForce assassin, delivering similar levels of performance in a package a fraction of the size, all at a nicer price. Let's see if it delivers.

HIGH BANDWIDTH MEMORY

We normally start these graphics card reviews with a lengthy diatribe about the inner workings of the GPU, but Fury X brings something much more interesting to the test-bench – an entirely new form of memory that will revolutionise the way today's graphics cards are built. Take the heatsink off your Radeon or GeForce and you'll see a GPU surrounded by around a dozen or so postage stamp-sized memory modules. For the GPU to access the data stored in these memory modules, it has to send and receive signals via traces

in the Printed Circuit Board, and with each measuring several centimetres in length, that takes time. Fury X does away with this memory layout entirely, adopting a new form of memory called High Bandwidth Memory, or HBM for short. This nifty technology was first proposed by AMD and Hynix way back in 2010, which was then adopted by JEDEC in October 2013. HBM uses 3D stacking of the memory chips to minimise the area required by the memory, which is then mounted on an Interposer. This Interposer then connects directly with the GPU, vastly increasing the speed with which the GPU can interact with said memory.

This is the reason the Fury X is so damn small, at just 194mm in length. The

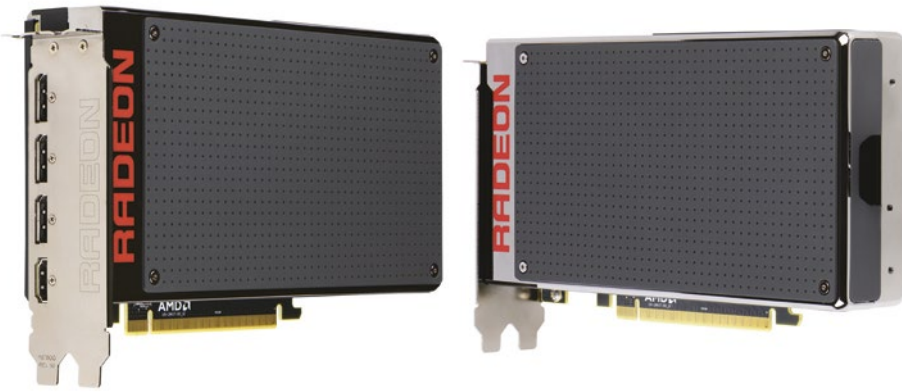
✓ On-die memory allows the Fury and Fury X to be almost half the length of GDDR cards



memory now occupies a tiny fraction of the space the old GDDR5 modules required; look at a close-up of the Fury X chip without a cooler in place, and you'll see four tiny squares surrounding the GPU. These are the memory modules, all 4GB of them. Yes, only 4GB, but we'll get to that in a moment.

The benefit of HBM is that it allows for extremely wide memory buses. Where the R9 290X had a 512-bit memory bus, the Fury X has a whopping big 4096-bit memory bus. Yet the memory only operates at 500MHz (it's DDR though), but thanks to the huge memory bus the total memory bandwidth is 512GB/sec. That's over half a terabyte of data being shunted around every second, which is a 60% increase on the R9 290X's 320GB, which is also the fastest memory bandwidth ever seen on a consumer graphics card. Even better, it only requires 15% of the power to achieve the same results as the older style of memory!

All of this memory bandwidth is perfect for driving the latest fad in PC displays, 4K monitors. Unfortunately there's one slight problem with the Fury X's implementation of HBM; yep, that 4GB limit we mentioned



WHO STOLE HDMI 2.0?

Considering this is a product intended for 4K gaming, and is small enough to fit inside a slick, HTPC gaming case, the lack of a HDMI 2.0 output is confounding. When asked about this decision, AMD replied that they're working with partners to develop an active DisplayPort to HDMI 2.0 adapter. Umm, yippee?

earlier. Fury X only ships with 4GB of HBM, and AMD won't talk about why, or when it'll release an 8GB version. As any GTAV player with one of these fancy 4K displays will tell you, 4GB just isn't enough to run today's cutting-edge titles at 4K resolution with all of the details set to high, especially texture detail. And when the GPU has to resort to fetching data from the PC's system memory, things grind to a halt, as accessing the RAM is an order of magnitude slower than accessing the dedicated GPU memory. To test what impact this has on the Fury X, we ran GTAV at 4K resolution with all of the bells and whistles. Thanks to the helpful in-game display, we could see that the game required 5382MB of graphics memory in this mode. Running the benchmark gave us a minimum frame rate of just 2.4fps, showing just how painfully slow the game must crawl to when accessing external memory.

However, by dropping the texture resolution and lowering the number of unique character models, thus also decreasing the amount of memory required while still pushing the same number of polygons, we were able to decrease the game's required memory to

4045MB. That's just inside the 4096MB of HBM memory on the Fury X. The minimum frame rate leapt to 15.52fps, which might not sound like a very high result but is a dead heat with the GeForce GTX 980 Ti's minimum framerate in the same benchmark. As such, we're not so sure Fury X is going to be the 4K-enabler AMD claims it is. And we pity the AMD marketing team who has to somehow promote the huge 8GB of onboard memory on the new Radeon R9 390X, without implying that 4GB on the Fury X isn't enough.

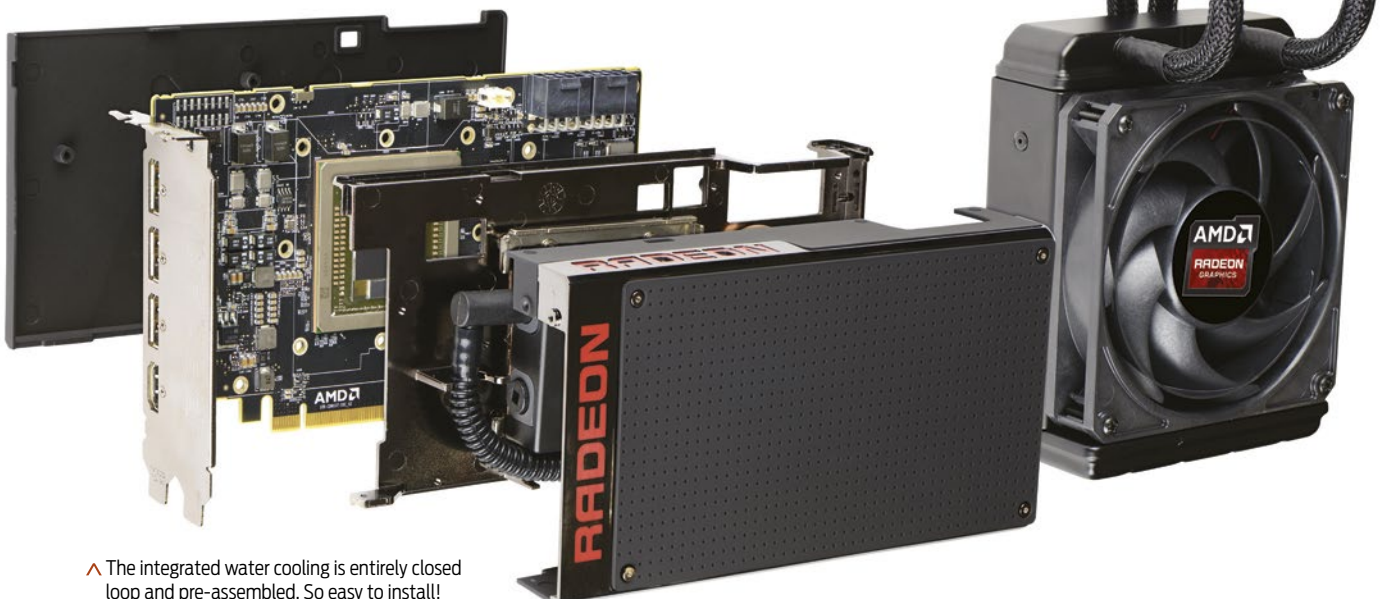
THAT'S A BIG CHIP

While the memory is exciting stuff, despite our hunger for more of it, the GPU isn't quite so revolutionary. It's built using the same Graphics Core Next (GCN) 1.2 design found in the R9 285 mid-range processor released late last year, just more of it (GCN 1.2 was a slight update to the GCN 1.1 found in the R9 290X, focusing on more features rather than straight out performance improvements). Compared to the R9 290X, the Fiji chip at the heart of Fury X has had a huge shot in the arm, with 64 Compute Units delivering a total of 4096 Stream Processors, a

massive increase over the 2816 found in the R9 290X. It's also got more Texture units, up from 176 to 256, and this is why the chip required 9 billion transistors to build. They're of the 28nm flavour, which explains why this is a relatively steam 275 TDP product. Yet the card foregoes an air cooler, like the ones found on AMD's new R9 390X which also had a TDP of 275W, for an All-in-One water cooler. We're guessing it's due to the small size of the card, but the end result is a remarkably quiet graphics card. Even while busting a gut running GTAV at 4K resolution, the total fan noise was just 45dB.

AMD DISCOVERS DOWNSAMPLING

As well as the usual AMD features – FreeSync, Frame Rate Targeting Control and CrossFire – the Fury X brings a long overdue tidbit to the table. Called Virtual Super Resolution, it's basically identical to



▲ The integrated water cooling is entirely closed loop and pre-assembled. So easy to install!

FURY X BENCHMARKS

3DMark Fire Strike Ultra (3840 x 2160)

Radeon Fury X: **3932**

Gigabyte GTX 980 Ti Gaming G1: **4480**

3DMark Fire Extreme (2560 x 1440)

Radeon Fury X: **7152**

Gigabyte GTX 980 Ti Gaming G1: **8191**

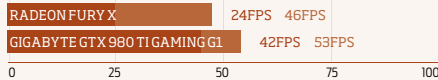
3DMark Fire Strike (1920 x 1080)

Radeon Fury X: **13315**

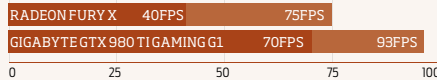
Gigabyte GTX 980 Ti Gaming G1: **15050**

SHADOW OF MORDOR

3840 X 2160, ULTRA DETAIL

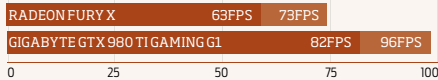


2560 X 1440, ULTRA DETAIL



GRID AUTOSPORT

3840 X 2160, 4XMSAA, ULTRA DETAIL



2560 X 1440, 4XMSAA, ULTRA DETAIL



METRO 2033

3840 X 2160, 4XMSAA, VERY HIGH DETAIL, SSAA OFF



2560 X 1440, 4XMSAA, Very High Detail, SSAA off



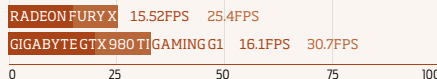
GRAND THEF AUTO

TORTURE TEST - 3840 X 2160. EVERYTHING MAXED EXCEPT: MSAA X4; REFLECTION MSAA: X2; GRASS QUALITY: VERY HIGH; SOFT SHADOWS: SOFTTEST; MOTION BLUR 0; FRAME SCALING DISABLED.

MEMORY USED: 5382GB



TORTURE TEST - 3 with SUB 4GB MEMORY USAGE. SAME AS TORTURE TEST BUT POPULATION VARIETY SET TO MINIMUM, AND TEXTURE QUALITY SET TO NORMAL. MEMORY USED: 4045MB



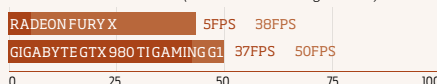
RADEON FURY X FAN NOISE: 45DB GIGABYTE GTX 980 TI GAMING G1 FAN NOISE: 49DB

BATMAN ARKHAM KNIGHT

BATMAN ARKHAM KNIGHT - 3840 x 2160, Ultra Detail, All GameWorks Features Disabled



BATMAN ARKHAM KNIGHT - 3840 x 2160, Ultra Detail, 2 of 4 GameWorks Features Enabled (Enhanced Rain and Light Shafts)



GTA5 Torture test - 5404MB memory used

GRAPHICS SETTINGS

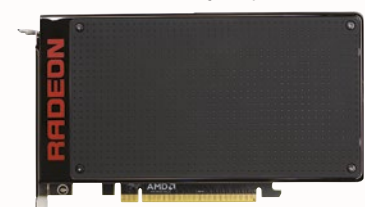
Resolution: 3840 x 2160; **FXAA:** off; **MSAA:** x4; **TXAA:** off; **V-sync:** off; **Pause game on focus loss:** on; **Population density:** max; **Population variety:** max; **Distance Scaling:** max; **Texture quality:** very high; **Shader quality:** very high; **Shadow quality:** very high; **Reflection quality:** very high; **Reflection MSAA:** x2; **Water quality:** very high; **Particles quality:** very high; **Grass quality:** very high; **Soft Shadows:** Softest; **Post FX:** Ultra; **Motion blur strength:** 0; **In-Game DoF:** on; **Anisotropic filter:** x16; **Ambient occlusion:** high; **Tessellation:** very high

ADVANCED GRAPHICS SETTINGS

Everything on or maxed, except Frame Scaling mode which is disabled

GTA5 Sub 4GB memory test - 4045MB memory used

Same as above, but Population Variety set to minimum, and Texture Quality set to Normal.



Nvidia's Dynamic Super Resolution (DSR), and makes downsampling a matter of simply enabling higher resolutions in the Catalyst Control Panel. For those of you unfamiliar with downsampling, it's a method of rendering the game at a resolution than that supported by the display, which is fantastic for removing jaggies, aka aliasing.

But enough about the technical fluff; you probably want to know how the Fury X performs. In a nutshell, it's bloody fast, but isn't quite a GeForce GTX 980 Ti killer. We compared it against Gigabyte's excellent GTX 980 Ti Gaming G1, which brings a healthy factory overclock to Nvidia's flagship graphics product, making it around 10% faster than a standard GTX 980 Ti.

The Fury X compared well in two of our benchmarks, FireStrike Ultra and Shadow of Mordor at 4K. In these tests it was within 15% of the Gigabyte card; remove Gigabyte's factor overclock and the Fury

X is basically neck and neck with a GTX 980 Ti Gaming G1. However, it didn't fare so well in the rest of our tests, with the GeForce product having an average of a 20% to 30% speed advantage. Despite this, we're confident AMD will claw back some of that ground as its drivers mature, as the 15.15 drivers we tested with were the first to officially support the Fury X.

And therein lies the problem – AMD might have hardware that isn't far off a GTX 980 Ti, but its driver support of late has been, well, shocking. With no WHQL release since December of 2014, the company needs to start investing in the software that drives its hardware. Don't even get us started on CrossFire support; let's just say that we'd rather game on a console than have to endure AMD's slothful release of multi-GPU ready drivers. If it can lift its game when it comes to drivers, we have no doubt that Fury X has some more performance up its sleeve. What drivers can't fix though is the

meagre amount of memory on the Fury X. With AMD remaining mum about when we'll see an 8GB of the Fury X, it's hard to recommend this card as 4K ready if AMD has something waiting in the wings.

Despite these quibbles, it's great to see AMD delivering a competitor that can go toe to toe with Nvidia. Even better, given AMD's cut-throat attitude to pricing, expect to see the Fury X landing at even more affordable prices than the RRP of AU\$979 come its release. Now if only AMD could be as impressive in the CPU space we'd be even happier.

Bennett Ring

KEY SPECS

\$979 • www.amd.com

4GB HBM memory • fully DX12 compliant • 2 x 8-pin power inputs

OVERALL



Basis Peak

WITH AN INTRIGUING, HANDS-OFF APPROACH TO FITNESS AND SLEEP TRACKING, THE BASIS PEAK FORGES ITS OWN PATH

Every small tech company dreams of piquing the interest of a giant such as Intel – and Basis has made that dream a reality. Intel was so enthralled by Basis' original vision of the activity tracker, the Basis B1, that it snapped up the company for its new Devices Group. Now Basis has unleashed the Basis Peak – a device it describes as “the ultimate fitness and sleep tracker”. That's quite a claim, but the Basis Peak is different to its rivals: this is a fitness tracker in the purest, most hands-off sense. A clutch of sensors monitor your vitals continually, and this stream of data allows the Peak to recognise sleep patterns, bike rides and runs – all without any intervention. Strap it to your wrist and you can get on with your day without giving it a second thought. The Basis Peak's simplicity makes a refreshing change from more hands-on devices. Start walking, running or cycling with it on your wrist, and after a few minutes the monochrome 1.2in LCD changes from the clock to a more informative screen, showing the elapsed time, calories consumed, your heart rate and the current time. There's no learning curve to speak of, no button presses required – it just works.

DESIGN

Rather like the company's first tracker, the B1, the Peak's design is more functional than fashionable. It's available in matte black, or light silver with a gloss black surround and white strap. There's no getting around it, however: at 13mm thick, the Peak is more chunky wearable than stylish sports watch.

Flip the Peak around and the rear is where all the magic happens. Four metal contacts are dotted around a central bank of sensors, all of which work in unison to measure heart rate, skin temperature, perspiration and the number of steps taken. Take off the Peak and a pair of blindingly bright-green LEDs flash insistently in search of a heartbeat.

Thanks to that power-efficient monochrome LCD screen, the Basis Peak also has one huge trump card over other devices: battery life is very good indeed. In several weeks of use, the Peak lasted between two to three days before its display pinged up a “Charge Me Now!” message.

THE INTERFACE

Basis has adopted a stripped-down approach to the Peak's interface. Just like an increasing number of wearables, the Peak captures an overwhelming amount of data, but the watch displays only the essentials – this isn't a device for fitness geeks that want to view every possible statistic on their wrist. Most of the time, the clock remains front and centre; a tap of the screen toggles the date on and off. You can check your heart rate by swiping the screen to the left, and swiping down from here provides the daily totals for steps taken and calories burned. Swipe right again, and it's possible to peruse a summary of the day's recent activities by scrolling up and down. Meanwhile, you can tap the screen during a run or ride to toggle the main display between current heart rate and total calories burnt. There's notification support, too, with alerts for phone calls, email, text messages and calendar entries popping up onscreen as your phone receives them.

The Peak lacks pedometer-based distance tracking, and a GPS for that matter; this isn't a fitness device that cares about how fast or how far you go. If that's essential for you, then the only option is to pair the Peak with a smartphone app such as Strava – in this scenario, the Peak acts as a glorified Bluetooth LE heart-rate sensor, the screen constantly displaying your heart rate in a large, easily legible font.

SETUP AND FEATURES

While its limitations may disappoint some, the Peak is elegant in its simplicity. All the data captured by the Peak flows into the cloud via the smartphone app, which is available for both iOS and Android. Once synced, it's possible to view all your activity data either on the app itself, or via a browser in Basis' online portal. By default, the graphing functions detail heart rate, steps taken and calories burnt, but it's also possible to toggle skin temperature and perspiration rate.

One of the Peak's best features is the ability to set Habits in the app. These include goals such as getting up or going to sleep at consistent times, burning a preset number of calories per day, or even just getting up and walking around now and again. You can tailor these goals to suit, and completing them successfully

◀ This is no sleek smartwatch – the Basis Peak has a far more chunky design

earns points that allow you to add extra Habits to the list.

The sleep tracking is impressively thorough. The Peak monitors when you drop off and wake up and analyses how much of your night is spent in REM, deep and light sleep states, as well as how many times you toss and turn, and interruptions such as popping downstairs to get a drink.

The only downside? Sitting very still at a desk, in the cinema or while watching TV may be enough to trigger the Peak into thinking you're having a nap. Basis' sleep algorithm clearly isn't infallible.

VERDICT

It all makes for a very curious wearable. For true fitness fanatics, the Basis Peak is unlikely to hit the spot. The inability to export data to other apps or record GPS-tracked rides and runs – not to mention the lack of any speed, pace or distance information – make it incapable of replacing more fully featured devices, such as the Microsoft Band.

Meanwhile, those wanting a do-it-all fitness wearable and smartwatch may be put off by the crude notification support, especially since much of the data captured doesn't seem to serve much purpose.

Despite all this, there's something intriguing about the Peak. At its best, it's a fuss-free way of tracking your daily habits and changing them for the better, and the sleep tracking seems pretty

accurate too. There's no getting away from the sense that the Basis Peak is a hi-tech toy rather than an essential fitness wearable, but if your focus is more geeking out than bulking up, then it may hit the spot.

Sasha Muller

KEY SPECS

\$380 • www.mybasis.com

1.2in monochrome touchscreen • optical heart-rate monitor • 3-axis accelerometer • galvanic skin-response sensor • thermal sensor • water resistant to 5ATM (IP68) • Bluetooth 4 LE • iOS and Android compatible • 1yr RTB warranty • watch body only, 42 x 13 x 44mm (WDH) • 48g (including strap)

OVERALL



Dell Chromebook 11 (2015)

IT'S NOT PRETTY, BUT THIS YEAR'S DELL CHROMEBOOK 11 IS STURDY, PRACTICAL AND - BEST OF ALL - CHEAP

There are times when good looks and sleek design must take second place to practicality – situations when tough is more important than pretty. So it is with the 2015 edition of the Dell Chromebook 11. It may not be stylish, but it's unfussy and practical, and for the target market – the education sector – that's exactly what's needed.

That's not to say that Dell has skimped on design. The manufacturer says the laptop has passed US Military Standard testing, and while you're unlikely to need to use it under enemy fire, that sturdiness means it's more than equal to the knocks of student life. It's covered in solid-feeling matte-black plastic that hides any smudges or scratches, and encircled by rubber bumpers that protect against drops. Open it up and you'll find a lid that can be swung back a full 180 degrees, with reinforced hinges that help to prevent any damage caused by excessive rough handling.

One distinctive feature aimed specifically at classroom use is the Chromebook's "activity light". Set into the corner of the lid, facing outwards, this light bar can be illuminated in three colours, allowing students to discreetly attract attention if they have an issue or want to ask a question. It's a smart addition that's aimed at helping teachers to encourage less confident students to contribute in class.

The sensible theme continues with the keyboard. The keys feel springy and responsive, and the layout is good too. However, we can't say the same for the touchpad: the integrated buttons are annoying to use when cutting, pasting, dragging and dropping between multiple windows.

As for ports, there's HDMI 1.4 out, one USB 3 and one USB 2, plus you get an SD

✓ The "activity light" indicates if a student needs help or has a question for the teacher



> Sturdy and practical – the Chromebook is ideal for student life

slot and 3.5mm headset jack. There's also a 720p webcam, dual-band 802.11ac Wi-Fi and Bluetooth 4 for a pretty comprehensive wireless-connectivity setup in this machine.

As with last year's Chromebook 11, the weakest part of the package is the screen. The 1,366 x 768 TN panel is dull: it suffers from poor vertical viewing angles and a low maximum brightness of 239cd/m² – which could make it hard to read in a sunny classroom – and a drab contrast ratio of only 306:1.

Under the hood is a 2.6GHz dual-core Intel Celeron N2840, backed by 4GB of RAM and 16GB of storage. This Celeron is based on the Bay Trail-M architecture, and as a result isn't quite as powerful as last year's model, which used the Haswell-based Celeron 2955U. It completed the SunSpider JavaScript test in 526ms and scored 1,453 in the Peacekeeper browser test, placing it close in performance to the midfield Asus Chromebook C200.

Still, the nature of Chrome OS and the fairly low-power, browser-based tasks that run on it mean this isn't a huge problem, and it feels responsive and smooth in day-to-day use. The laptop starts up in seconds, and even with 15 tabs open, we experienced very little slowdown.

The Chromebook 11 performed well in our battery testing, lasting 7hrs 35mins with a constant video loop and screen brightness of 120cd/m² – more than enough to get through a school day.

The speakers are good too: there's



some distortion when you push the volume over 80%, but overall the sound is surprisingly loud, and clear enough to fill a classroom.

Overall, the Dell Chromebook 11 remains an excellent device for those who need a well-priced, practical laptop. It's light enough to carry around and rugged enough to handle a beating, and the price remains reasonable, at \$479 for the non-touch version with 2GB of RAM or alternatively \$599 for the 4GB touchscreen version.

If you're looking for a more stylish laptop, the similarly priced Toshiba Chromebook 2 or the HP Chromebook 11 make good alternatives. But neither combines toughness and practicality like Dell's rubber-encased Chromebook 11.

Thomas McMullan

BATTERY LIFE

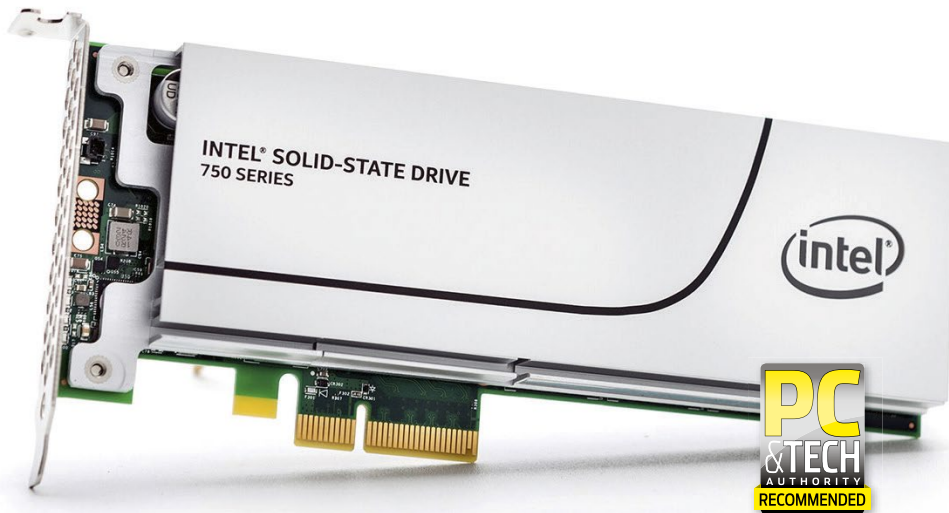


KEY SPECS

\$479 · www.dell.com.au
 2.6GHz Intel Celeron N2840 · 4GB RAM · 16GB storage · SD slot | 11.6in 1,366 x 768 display · 720p webcam · 802.11ac Wi-Fi | 43Wh three-cell Li-ion battery · Chrome OS · 1yr NBD warranty · 297 x 217 x 23mm (WDH) · 1.2kg (1.7kg with charger)

OVERALL





Intel 750 SSD 1.2TB PCIe SSD

INTEL CLAMBERS BACK ATOP THE SSD FIELD

We have Intel to thank for bringing consumer SSDs out at an affordable price, with its release of the impressive X25-M way back in 2008. This revolutionary product introduced desktops to the phenomenal speed increases offered by solid-state storage, and it led the field for a good year or two. Eventually SandForce caught up and Intel's drives were relegated to second place, with their performance eclipsed by much cheaper offerings. Since then Intel has struggled to deliver top-tier performance, with buyers instead likely choosing Intel SSDs for their impeccable reliability history, something other drives struggled with. But with the latest generation of SSDs such as Samsung's 850 Pro offering 10 year warranties, even that advantage has slipped away. Intel needed to do something new to recapture the attention of the SSD market, and it has done so in the Intel 750 and its use of a new technology known as Non-Volatile Memory Express, or NVMe for short.

This is a brand new specification for controlling SSDs that are attached directly to the PCI Express bus. It replaces the Advanced Host Controller Interface (AHCI) standard that has been used to access hard drives for the last decade or so, which was originally built to handle magnetic mechanical drives. NVMe is designed from the ground up for the massive amounts of parallelism and low latency offered by SSDs. The biggest difference is in the command

queuing offered by NVMe compared to AHCI. A hard drive's command queue optimises the order in which read and write commands are executed, and AHCI had a maximum queue depth of 1 command queue, and 32 commands per queue. NVMe increases the number of command queues and commands per queue exponentially, to a massive 65536 command queues, each of which supports another 65536 commands per queue. This allows for a huge increase in SSD performance, especially when it comes to IOPs, or Input Output Operations Per Second.

Intel is the first to market with a consumer SSD utilising NVMe, and is releasing it initially in two capacities – 400GB and a whopping 1.2TB. That explains the rather high pricing, but cost per Gigabyte is actually extremely competitive, with our 1.2TB coming in at just \$1.34. This is well within the price range of other PCIe drives, and is in fact cheaper than most of them. The memory used on the 750 is Intel-Micron's 20nm 128 Gbit MLC NAND, and our 1.2TB model has 18 memory packages on the front side, with another 14 on the rear. This gives the drive a total of 1.376GB of memory, but Intel advertises it as a 1.2TB drive as this is the total usable space – it's nice to see more SSD makers are now only advertising the usable amount of space, rather than the total.

Intel is using its CH29AE41AB0 controller to handle all of this memory,

and it brings full power loss protection to the drive. Even if you have data in the cache of the drive at the time of power loss, this SSD should retain said data, a big improvement over the semi-power loss protection of other SSDs, which only protects data that has already been written to the main storage.

The Intel 750 is available in two form factors – there's the half-height, half-length PCIe version that we tested, along with a 2.5" 15mm drive. The latter was shown off extensively at Computex, as it uses a new SFF-8639 connector, which was shown on many upcoming motherboards. It uses four PCIe lanes to maximise the throughput, and we can expect to see this becoming standard on motherboards in the near future, likely replacing the inferior SATAe option.

So just how does the Intel 750 perform? In a word – breathtakingly. This is easily the fastest consumer drive we have tested, and by a large margin. It's not so good at sequential performance, as Intel has instead focused on random read/writes, which is far more useful in the real world, but it still leads the pack with a sequential read result of 693MB/sec, and a write speed of 737MB/sec (the 850 Pro does 511MB/sec and 478MB/sec respectively). In the 4K QD16 test, which mirrors real world application performance, we see the 750 posting a read speed of 528MB/sec and 979MB/sec, compared to the 850 Pro's 378MB/sec and 341MB/sec. The IOPs tests were in another league, with read performance around 40% faster than an 850 Pro at 135,074 IOPs, and read performance almost 300% faster at 250,536.

Make no bones about it, Intel has leapfrogged the competition with the Intel 750. Considering its excellent performance, data protection and competitive price, there's simply no alternative for those who want the absolute best SSD on the market when it comes to random read/write performance, and it's not too shabby at sequential transfers either.

Bennett Ring

KEY SPECS

\$1499 • www.intel.com.au

Requires x4 PCIe slot with PCIe 3.0 x4 lanes • 1.2TB usable capacity • 5 year warranty

OVERALL





HyperX Predator 480GB PCIe SSD

PCIe POWER TO THE RESCUE

Poor Kingston has been doing it tough of late. Once the king of the memory market, it used its inside knowledge of flash memory to release a range of competitive SSD drives in the earlier generations of solid state storage. While its first SSDs were up to snuff, sadly more recent models have had to face off against the likes of Samsung's incredible 850 Pro, and Kingston has consistently come off second best. The good news is that its latest product recaptures the glory days of old, with the aptly named Predator making use of the extreme bandwidth offered by PCIe to catapult well past today's lowly SATA 3 drives.

Powering the Predator is Marvell's new 88SS9293 controller, which utilises four lanes of PCIe bandwidth to deliver stellar performance. Interestingly it only requires four lanes of PCIe Gen 2.0, whereas Intel's new 750 needs the same number of lanes but of the newer 3.0 variety. Yet even with the slower PCIe 2.0 format, this drive's interface offers up to 3 times the performance of SATA 3.

The Predator is available in two different form factors. The version we reviewed comes on the usual half-height, half-length PCIe card, but if you look at the photo you'll see that there's an M.2 drive screwed to it. Kingston is also offering the drive without the PCIe card as a standalone M.2 drive, but if you buy the PCIe version you're not allowed to unscrew the M.2 drive; doing so will void the warranty. This is a bit of a shame, as we can envisage users with older motherboards using this product in its PCIe form, and then wanting to use

it as an M.2 drive when they upgrade to a motherboard that includes this connection type.

Kingston has used the same memory found on a large portion of today's consumer SSDs, in the form of Toshiba's ubiquitous A19 MLC memory. There's actually 512GB of it on the SSD, but only 480GB is usable, and once again we're happy to see an SSD advertising the usable space, not the total. This is a fully bootable SSD, and will work on most motherboards, unlike Samsung's troublesome M.2 drive, which requires some driver fenangling to get working.

Kingston includes a fully licensed key to Acronis True Image in the box, which makes cloning your old hard drive an absolute breeze. There's also another desktop bracket included, in case the full length PCI bracket doesn't fit on the rear of your PC case. A three year warranty is also included, which might have once seemed quite lengthy but now pales in comparison to the five and ten year warranties that are standard elsewhere in the market. Kingston rates the drive as being able to handle 1.7x (x of drive capacity) drive writes per day, for a total of 882TB, which sits around the middle of the pack compared to other SSDs.

The Predator's marketing material states that this drive's performance when handling incompressible data clocks in at 1100MB/sec read and 910MB/sec write. Our Anvil's Storage Utilities test showed this to be bang on the money, with the sequential read test actually coming in faster, at 1280MBs/sec. Meanwhile sequential write performance clocked in at 899MB/

sec. This is easily the fastest sequential performance we've seen, even faster than Intel's new 750, which has a focus on random read/write performance instead. However, smaller file transfer speeds aren't quite as impressive. The 4K QD16 test showed a read speed of 307MB/sec, which is slower than the 850 Pro's 378MB/sec. Thankfully 4K QD16 write speed was much speedier, measuring 459MB/sec compared to the 850 Pro's 341MB/sec. The 4K QD16 IOPs test mirrored these results, being slower than an 850 Pro when reading by 19% at 78,497 IOPs, yet faster at writes by 34%, at 117,489 IOPs.

With a price per gigabyte of \$1.39, the Predator is one of the more expensive drives on the market, especially considering the three year warranty. However, its sequential read/write performance is simply unrivalled, even beating Intel's new 750 to the punch. Random read/write performance isn't quite so blistering, with slightly average read tests, but these are balanced out by extremely fast writes. As a result we're happy to say that the Predator takes its rightful place atop the SSD pile next to Intel's new 750, especially for those who will be carrying out large file copies.

Bennett Ring

KEY SPECS

\$699 · www.kingston.com

Requires PCIe x4 slot, with PCIe 2.0 x4 lanes; 480GB usable capacity · 3 year warranty

OVERALL



Acer Aspire R14 (R3-471TG)

A WOLF IN SHEEP'S CLOTHING

This machine was supposed to be in last issue's mainstream laptops group test, but an unfortunate courier incident saw it miss out. It would have stacked up reasonably well, so let's have a look now. Its strongest feature is the i7 5500U CPU. At this price most competitors offer an i5, or even a Core M. The Lenovo Yoga 3 14 for example is very similar in spec, with an identical CPU, similar form factor but is \$400 more. With that machine, however, you get a superior GPU (Nvidia 940M vs Nvidia 820M for the Acer), a higher resolution screen and an SSD.

The 820M GPU won't be much chop for gaming at high detail, and its 1TB hard drive won't compete for read and write speed – so what we have here is a good CPU at a reasonable price, but if that's your priority you will want to weigh up its cons. It's quite noisy at load, or even at idle with the fan louder than most recent laptops we've used.

The screen can fold all the way over for tablet-style use, or leave it half way

folded for 'tent mode'.

There are disappointments with build quality. Most alarming is the chassis the keyboard sits on – the entire plastic cover bends inward as you type, and with a movement of around half a centimetre! Just as bad, the entire case can be bent with just two fingers, so



it's not just the case outer that is thin and weak, the internal structure also doesn't appear to be reinforced. On top of that, the screen wobbles badly when using touch – which, interestingly, is contrary to its advertising claims.

Overall, if it is to remain deskbound, and serve primarily as a number-crunching machine it's fine and reasonable value. But with a relatively low screen resolution its utility as a design or gaming machine is limited.

Most of all, we wouldn't feel safe taking it out on the road frequently; it just doesn't feel durable or built from quality materials.

Ben Mansill

KEY SPECS

\$1499 • www.acer.com.au

Intel i7-5500U 2.4GHz (3GHz turbo) • 14inch 1366 x 768 touch screen • 1TB HDD • 2GB Nvidia 820M • 2.2kg\

OVERALL



D-Link 4G LTE VoIP Router with SIM Card Slot DWR-922

WI-FI VOIP, WHICH MAY BE JUST THE THING FOR A SMALL OFFICE

The D-Link 4G LTE VoIP Router with SIM card Slot, unlike ADSL2+ or cable modem routers, takes advantage of the increasing proliferation of 4G services to get you online.

The D-Link router currently ships with a Globalgig 4G SIM card with \$30 of credit. Once the SIM is registered and inserted into the back of the router, the D-Link uses Globalgig's 3G/4G network (supplied via Optus) to get you connected to the Internet. You can also use data SIM cards from other network providers, but be aware that this router does not work with the newer 700MHz frequency used by Telstra & Optus. This

means you will be sharing bandwidth with other devices on the older 1800MHz frequency.

The router is capable of 4G download speeds up to 100Mbps and upload speeds of 50Mbps, but your experience will depend on the quality of the connection available to you. Its two removable 3G/4G antennae do help to improve the incoming signal. As always with mobile broadband, keep one eye on your data quota to avoid bill shock.

The D-Link has a WAN port which allows for secondary connectivity to an ADSL or cable modem, and is capable of automatically failing over to the wired connection if 3G/4G is unavailable, or vice versa.

Device connectivity to the router can be achieved using one of the four Gigabit Ethernet ports, or wirelessly via the 802.11b/g/n protocols. However, with no external antennae to increase the Wi-Fi signal, wireless reception deteriorates

quite markedly the further you move away from the router.

The D-Link router has an RJ-11 FXS VoIP port to allow for compatible handset connectivity, but strangely VoIP does not work if you use Globalgig's 4G service, despite its Optus partnership.

The D-Link router also has a USB 2.0 port for network printing or storage, dual active SPI and NAT firewalls, SMS capability (via the admin console), and standard router functions, such as port forwarding, DMZ, QoS and parental controls (URL or domain blocking).

Peter Gutierrez

KEY SPECS

\$249.95 • www.dlink.com.au

3G/4G-LTE compatible • 802.11b/g/n • 4 x Gigabit Ethernet ports, 1 x VoIP port

OVERALL





DrayTek Vigor 2860ac VDSL2 Security Firewall

A FULL FEATURED ADSL MODEM ROUTER WITH 802.11AC WI-FI

If you're after a bang for buck ADSL modem with Wi-Fi, the DrayTek Vigor 2860ac probably isn't the unit for you -- I'll get to why, later. But if you need a router with unique enterprise level features like load balancing, QoS, a content filtering and stateful inspection firewall, USB 3G/4G modem support, centralised traffic analysis and management, then you'll probably have the DrayTek Vigor 2860ac high up on your list.

The DrayTek Vigor 2860ac isn't exactly cheap, with a street price of around \$479. You can get an 802.11ac ADSL router like the TP-Link Archer D5 for only \$150 or less. What then, justifies the DrayTek's relatively higher price?

Hardware wise, the 2860ac doesn't have many standout features. The wireless chipset runs the AC1300 variant of 802.11ac, which isn't top of the class in 2015. But that's only useful if you've got devices on your network with support for the three data streams on 802.11ac to reach those marketed speeds. The 6 port gigabit switch built in is a nice change from the usual 4 ports found on most modem & router combos. The only unique hardware features on the 2860ac are support for ITU-T G.993.2 VDSL2 (aka, the poor man's fibre to the node NBN or TPG's fibre to the basement) and two USB ports that allow a 3G/4G modem or external

storage to be attached. A nice little detail that underlines the 2860ac's enterprise qualities, is the fact all the ports & buttons are on the front of the unit and there's nine status LEDs for various things -- making it easy to diagnose on the phone with a non-technical user or just by glancing at it in a comms cabinet.

Where things get interesting however, are in the software. DrayTek has packed the 2860ac full of high-end enterprise level features. To go into them all in this review would take up the entire magazine -- but I'll mention a few highlights here.

The firewall built in to the DrayTek is quite advanced, supporting stateful packet inspection and a content filter. You can filter traffic down to the protocol (i.e: web, P2P, etc.) beyond basic ports, so if someone on your network just uses a blocked service on a different port than standard, you can still block the traffic. Content filtering is another firewall feature that can block specific URLs and domains, even keywords. There's support for Cyren GlobalView based filtering, which adds the ability to restrict categories of websites, such as shopping or adult sites for example.

DrayTek include its SmartMonitor network traffic analyzer in the 2860ac, giving you a great overview of who's using what and what services are using

the most traffic. It's only for the wired portion of the unit though, SmartMonitor doesn't log Wi-Fi usage. A nifty feature most consumer models won't support and would be useful even in the home environment.

If you're deploying multiple 2860ac units -- for example in a couple of remote offices -- DrayTek has a feature called Central VPN Management, allowing relatively easy VPN setup all from a centralised location. There's a plethora of VPN options in the 2860ac's firmware too, even the ability to trunk VPNs over multiple WAN connections for increased bandwidth.

DrayTek also manufacture wireless access points and the 2860ac can act as a centralised management interface for multiple access points spread around a large area. Great feature for extending a wireless network without a loss of performance, or for balancing a high amount of wireless users over multiple access points to prevent congestion.

My favourite feature on the 2860ac is the ability to load balance and fail over with multiple Internet connections. For example, if you've got ADSL that likes to crap out often, you can connect a 4G modem to the 2860ac's USB port and configure the router to automatically switch all traffic over to the 4G connection if it notices the ADSL connection has dropped out, then revert back to ADSL when it works again.

There's no doubt that the Draytek Vigor 2860ac is a serious bit of kit. Specs wise, you'll get cheaper and better elsewhere. The DrayTek's firmware is a class above most consumer-level models and is the reason it costs a fair bit more than a TP-Link or Linksys. None, if any all in one units at this price range have the enterprise level features of the 2860ac and an entry level Juniper or Cisco device would not be as straightforward to setup. The 2860ac is a great medium between consumer and enterprise in terms of features, ease of use and price.

Anthony Agius

KEY SPECS

\$479 • www.draytek.com.au
ADSL2+/VDSL2 modem • 802.11ac AC1300 Wi-Fi • 2x USB ports • 6-port Gigabit Ethernet switch

OVERALL





Linksys Max-Stream AC2600 MU-MIMO Gigabit Router EA8500

FANTASTIC TECHNOLOGY BUT A TAD PRICEY FOR THE MOMENT

The Linksys Max-Stream AC2600 MU-MIMO Gigabit Router EA8500 addresses the problems faced by multi-device households. The router itself is an imposing piece of kit, occupying same amount of desk space as a laptop, with four large, removable antennae. Housed within the chassis is a 1.4GHz dual-core processor, 512MB DDR3 RAM, and 128MB flash memory, providing substance to match its looks.

What separates the EA8500 from other wireless routers on the market is its use of an emergent wireless technology, called Multi-User Multiple Input Multiple Output, or MU-MIMO. This works to make more efficient use of the available wireless bandwidth this router provides, using its Qualcomm MU/EFX 802.11ac Wi-Fi chip.

Many 802.11ac routers and Wi-Fi access points use Single-User MIMO, or simply MIMO. This means it broadcasts its full Wi-Fi bandwidth to all wireless devices on a network, one device at a time. Full bandwidth sounds great, except most wireless devices simply aren't capable of receiving this amount of data. For example, a wireless router may have a maximum Wi-Fi rate of 1300Mbps, but an iPhone 6 can only receive a Wi-Fi input of 433Mbps. If the iPhone were to connect to this wireless router, it would still be fed the full 1300Mbps by the router, meaning

867Mbps of bandwidth isn't utilised.

MU-MIMO works by transmitting and receiving multiple Wi-Fi data rates simultaneously to multiple devices. It's functionally similar to having dedicated wireless routers servicing separate data rates. The net effect is that a wireless device should only receive the amount of Wi-Fi data that it's capable of handling. In reality, there aren't that many consumer devices out there yet that are fully compatible with MU-MIMO, so you won't get the full download and upload benefits MU-MIMO can potentially provide, but you will still notice a difference. By comparison, dual-band and tri-band routers also promote multi-user support, but because they use Single User MIMO technology, they're only broadcasting full signal to multiple devices sequentially, within each radio band.

To test the EA8500's MU-MIMO capabilities, I wirelessly connected an Apple TV, iPad Air 2, Galaxy Note 4 and an HTC One to the EA8500, which in turn was connected to an ADSL2+ modem, then commenced streaming Netflix on all four devices simultaneously. Playback was seamless, with no buffering or lag, and the quality of the picture on all four devices remained consistently sharp.

Getting the EA8500 up and running can be done with a setup wizard, providing

wireless connectivity within minutes, or manually, for those that like to get their hands dirty. Administration of the router can be also done remotely, by creating a Linksys Smart Wi-Fi account and registering the device. This also gives you access to administer your router using the Linksys Smart Wi-Fi mobile app (iOS and Android). Its web interface is easy to navigate and intuitive, although network-savvy users may rue the absence of wireless configuration, particularly with frequency settings and band selection.

The EA8500 transmits at the 2.4GHz and 5GHz frequencies, so you can choose to specify separate SSIDs for each frequency and segregate your wireless network that way, or choose to use the same SSID for both, and allow the router to automatically allocate devices to their required frequency. While speeds on the 5GHz frequency felt snappy, the 2.4GHz frequency's speed was average, at best. Having said that, the Wi-Fi range is quite impressive. I measured 90 metres, with a clear line of sight to the router.

Providing further connectivity options are four Gigabit Ethernet ports on the back, a USB 3.0 port and an eSATA/USB 2.0 combo port. Its capabilities in providing network storage are to be commended, distributing content via file-sharing or streaming protocols. You can also enable secure sharing by creating user accounts. Strangely, however, it doesn't currently support Apple's Time Machine functionality. I saw write speeds close to 90MBps and 100MBps for read through the USB 3.0 port, which is dedicated NAS territory.

It's not cheap at \$429.95 MSRP, but if you want to be at the cutting edge of multi-device wireless technology and be future-ready as MU-MIMO compatibility becomes more prevalent, with NAS-level network storage capabilities to boot, you can't go wrong with the EA8500.

Peter Gutierrez

KEY SPECS

\$429.95 · www.linksys.com/au/

Dual-core 1.4GHz processor · Qualcomm QCA9980 Wi-Fi chipset · 4 x Gigabit Ethernet, USB 3.0, eSATA/USB2.0

OVERALL





Nvidia GTX 980 Ti

AND THE LATEST NVIDIA CARD IS JUUST RIGHT.

We've had the GTX 980, the flagship of NVIDIA's 9-series of graphics cards. We've had the superlative but nigh unaffordable Titan X, which showcases what the second generation Maxwell cores are truly capable of.

And now, we have what a lot of gaming enthusiasts have really been waiting for, the GTX 980 Ti. The Ti series of cards has traditionally been the true performance card in each series, packing in great performance for a reasonably affordable price – though, in this iteration, that idea of affordable is somewhat stretched.

The underlying silicon is basically the same core that didn't make the grade for the Titan X, though this is not to say the hardware is flawed. Every company that pushes silicon goes through the process of 'binning' to find the best of a particular batch of product – whether it be CPUs, GPUs, or even RAM – to find the ones that perform best, and then markets them as separate products.

On board is what Nvidia calls its 'Big Maxwell' GPU, and it runs at a stock 1000MHz, backed by 6GB of GDDR VRAM.

This is supported by a 384-bit memory bus, an impressive 2,816 CUDA cores, and sucks down relatively power-conscious 250 watts of power.

The card also has full support for the new DirectX 12 API, though since that's only coming with Windows 10, it's not something we can really test right now. That said, when it does come, Nvidia promises that this will be the card for high-end gaming, and virtual reality set-ups.

What you will see now, however, is just about the only single-core solution that can easily handle 4K gaming. The Titan X can do it pretty easily, but you'd expect that in a hand-picked GPU backed by 12GB of RAM – and that costs around \$1600.

The GTX 980 Ti is currently going for between \$1000 and \$1150, depending on which vendor you're going with. The card we're looking at here is the Nvidia reference card – which is essentially what a few vendors, like Galax and Asus are doing for their initial offerings. It's cooled by a single fan and an array of cooling fins, and while it is a very quiet solution, it does

tend to run hot at between 70 and 80 degrees Celsius under load.

However, you are getting some pretty good performance out of that. We tested at 4K resolutions (3840 x 2160) on a shiny new Acer XB280HK 28in display, with G-Sync. Before we even get to test results, the combination of 980 Ti and 4K and smooth frame rates is simply a revelation. Prior to its release, we saw a preview of Grand Theft Auto V running at a similar resolution, on an SLI setup – seeing the same performance on a single card, with a single core, is pretty amazing.

In terms of our regular benchmarks, performance is pretty much as you'd expect, setting pretty firmly between the GTX 980, and Titan X. In the built-in Shadows of Mordor benchmark, running at the highest Ultra quality, the Ti achieved 44 frames per second, which places it firmly ahead of the GTX 980 with a mere 34fps, and not too far behind the Titan X, which topped an average of 48fps. In the synthetic Firestrike test in the latest 3DMark, the 980 Ti was slightly less impressive – though that's hardly surprising. It scored 12,984, which places it closer to the 980's result of 11,544 than the Titan X's impressive 15,232. Firestrike at 4K is a remarkably intense test of a card's physics capabilities, so this isn't all that surprising, and all our other real world testing – in games like Battlefield 4 and The Witcher 3 – suggest that it's more than capable of handling games that would kill any other GPU at 4K settings.

The current competitor to the GTX 980 Ti would have to be AMD's R9 295X2, which is about the same price, and offers similar or even better performance – on paper – and assuming what you're playing works with CrossFire. The advantage that the Ti has is that Nvidia's driver support is excellent, with an update made for nearly every major PC game release; by comparison, AMD's last WHQL driver update for similar resolutions was in September 2014 (at time of writing), and everything since then has been beta releases. And still late! This doesn't even take into account that many games play less than well with CrossFire.

For our mind, for the price and performance, this is the best card you can buy today.

David Hollingworth

KEY SPECS

\$999 • www.nvidia.com

6GB GDDR5 RAM • DX12 compatible • 600 watt PSU minimum.

OVERALL

0 1 2 3 4 5





Gigabyte GV-N98TG1 GAMING-6GD

GIGABYTE'S DEBUT GTX 980 TI

Gigabyte is usually first out of the gate when it comes to supplying PC & Tech Authority with new samples of Nvidia graphics cards, and the GTX 980 Ti is no exception. We had its new GV-N98TG1 Gaming-6GD graphics card sitting in our test bench before other companies even had a chance to email us about their samples, and this is mirrored in stores, where Gigabyte cards are often the first to show up on shelves. The version of the GTX 980 Ti we're reviewing here is slightly different to most of the GTX 980 Ti products currently on sale though, as it's been given the full Gigabyte overclocking treatment. This comes with a small price premium, so let's see what extra goodies the \$60 premium brings with it.

At the heart of this graphics card is Nvidia's new GTX 980 Ti chip, which is basically a slightly trimmed down Titan X GPU. It's been paired with 6GB of GDDR5 memory, half that of a Titan X. However, Gigabyte has not used a reference PCB to host these components, instead shipping this card on a proprietary black PCB. It comes with eight phase power, which is fed via twin 8-pin power connectors. The rear of the card is equipped with a metal backplate, while an illuminated LED on the top of the card can be customised to run in one of seven different colours, in case you're getting blingy with it.

Gigabyte has equipped the card with its new Windforce 3x 600W cooling system. This uses the same triple-fan layout we've seen on past Windforce solutions, but Gigabyte claims that it's now able to handle a whopping 600W of heat. Considering the GTX 980 Ti has a TDP of 250W, the new cooler should be able to handle the load with ease. It's also packing Gigabyte's 0dB technology, where the fans don't spin at all while the card is handling puny 2D workloads.

Gigabyte has endowed this card with different outputs to standard GTX 980 Ti cards, in the form of 1 x Dual Link DVI-I, 1 x DVI-D, 3 x DisplayPort and a single HDMI 2.0. Any combination of these can be used to drive up to four displays thanks to Gigabyte's Flex technology, but sadly we haven't had enough spare monitors to test this feature out. With six outputs, the Gigabyte GTX 980 Ti has one more than standard cards, but it comes at a price – there's no air outlet at the back of the card to blow air outside of the case. Instead this card dumps all its hot air inside the case.

So how far Gigabyte has pushed this card compared to a reference card? After all, there's no point in putting eight-phase power on a custom PCB, all tucked away under a special cooler, just to ship a graphics card at the exact same speed as everybody else, right? It's possible to set the card in one of two modes via the included Gigabyte software – Gaming and OC mode. In Gaming mode, the base clock is increased from the default of 1000MHz up to 1152MHz, while the Boost speed increases from the default of 1075MHz up to 1241MHz. OC mode is even



more impressive, with a base speed of 1190MHz and a Boost value of 1291MHz. That's a massive 20% increase in Boost speed over the original, enough to catapult the performance of this card beyond a GTX Titan X. The OC mode produces slightly more fan noise, but we didn't find it unbearable in the slightest.

As we tested the reference GTX 980 Ti on the opposite page, we decided to put Gigabyte's version through even more stressful benchmarks, running them all at 4K resolution. As you can see, it managed to pump out playable performance in both Grid Autosport and Shadow of Mordor.

It might cost just a little bit extra, but the added 20% performance delivered by the factory overclock makes this the fastest GTX 980 Ti we've tested. At \$1099 we feel sorry for Titan X owners who shelled out \$1600 for lesser performance just a few months ago, but owners of this GTX 980 Ti have every reason to feel happy indeed.

Bennett Ring

KEY SPECS

\$1099 · www.gigabyte.com.au

6GB GDDR5 memory · factory overclocked · 1 x Dual Link DVI-I · 1 x DVI-D · 3 x DisplayPort and 1 x HDMI 2.0

OVERALL



GRID · 3840 X 2160, 4XMSAA, ULTRA DETAIL	MINIMUM	AVERAGE
GIGABYTE GTX 980 TI GAME MODE	78FPS	92FPS
GIGABYTE GTX 980 TI OC MODE	80FPS	94FPS
SHADOW OF MORDOR · 3840 X 2160, 4XMSAA, ULTRA DETAIL		
GIGABYTE GTX 980 TI OC MODE	42FPS	54FPS

Seagate Personal Cloud 2-Bay 8TB

INTENDED FOR HOME USE, THIS NAS CERTAINLY PACKS IN A LOT OF STORAGE CAPACITY AND IS ALSO MEDIA-FRIENDLY

The Seagate Personal Cloud 2-Bay 8TB is a consumer NAS device for the home. It has a minimalist design, piano black finish and set-top box dimensions. The appeal for home users lies in its ease of use, and its combination of media sharing and backup capabilities.

Once connected to your network via the Gigabit Ethernet port, setup via the device's webpage is straightforward, requiring a firmware update and setting up a Seagate Access account, which enables the cloud (remote access) functionality. You can also choose to run the two internal drives in RAID 0 (to make full use of all 8TB), or RAID 1 (halving the available capacity to enable redundancy)

during the device's setup.

You can upload files to the drive a number of ways. You can download and install the free Sdrive tool on your computer, which enables the Personal Cloud to appear as another drive, or you can connect a USB drive to one of the available ports on the box.

File access couldn't be simpler. The Personal Cloud can connect to smart TVs and current generation consoles via its DLNA certification, allowing streaming playback of videos and music. You can also stream or download content to your mobile or tablet by installing the free Seagate Media app. It also supports UPnP and iTunes streaming.

The Personal Cloud can also connect to a Chromecast, Roku player, Apple TV, and has an app environment, which can run Plex, BitTorrent Sync and WordPress (for webhosting purposes).

As well as the media storage functions, the Personal Cloud can schedule and store backups of your computer and



mobile device data, sync to your Google Drive or Dropbox account, be used as an FTP/SFTP server, and even a printer server. The price tag is a bit high, especially if you don't make use of all its features, but the Personal Cloud 2-Bay also comes in cheaper 4TB (\$599) and 6TB (\$729) sizes.

Peter Gutierrez

KEY SPECS

\$949 • www.seagate.com.au
2 x 4TB drives • 1 x USB 2 & 1 x USB 3 • 1 x Gigabit Ethernet

OVERALL



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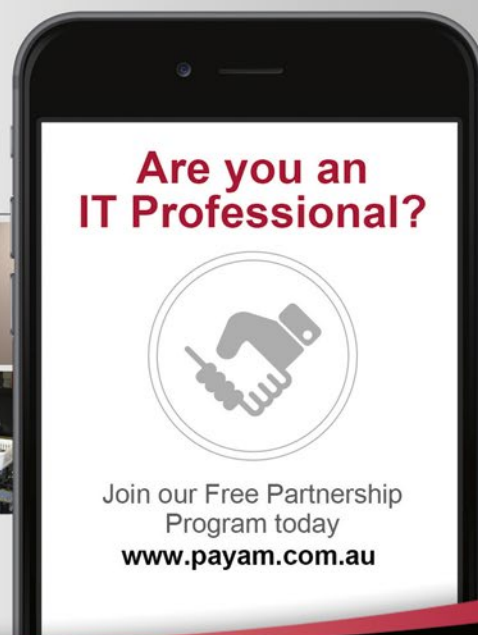
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Slingbox M1

A CLEVER PIECE OF KIT, BUT SLING HAS BEEN BYPASSED BY THE WORLD OF ON-DEMAND AND CATCH-UP TV

The Slingbox M1 is not your everyday TV streamer. Instead of delivering catch-up content from online sources direct to your TV, the Slingbox allows you to take remote control of an existing cable or satellite box and stream its content to your laptop, tablet or smartphone.

It sounds exciting at first. A thing you'd want to do, just because. But what are the practical benefits – if you're not in a position to splash out around \$170 just for the sake of it?

Well, there are a few applications. If you're the type who hoards recordings of movies on your set-top box, for instance, the Slingbox M1 provides a way of accessing these recordings quickly and easily from any device, from anywhere on the planet.

It's also useful for live sports: if you want to watch the big match while you're away, it should offer a better way of doing it than trawling the internet for a dodgy stream. And if you're desperate to catch something on live TV before your Twitter stream gets clogged with spoilers, it's good for that too.

Setting it up is simple enough: plug the M1 into the video and audio outputs of your set-top box, and connect the outputs on the Slingbox to the corresponding inputs on your TV. This allows the box to intercept the signal, encode it ready for streaming, and pipe it over the internet, or your local network, to your laptop, tablet or smartphone.

Video connections are made via composite or component cables (HDMI won't work due to HDCP restrictions), the box connects to the internet via dual-band 802.11n Wi-Fi or Ethernet, and control over your box is provided via an IR blaster integrated into the rear of the Slingbox. (The box also ships with an

extender you can stick to the front of your set-top box if the integrated transmitter doesn't work with your setup.)

Once you've set up an account on Sling's website, you're good to go. Sling provides apps for all the major mobile operating systems, including a Modern app for Windows. These apps even support Google Cast, so you can send content directly to a TV via a Chromecast. The simplest way to connect to your Slingbox, however, is to install either the Windows or OS X desktop application.

In general, the system works well. I hooked up the Slingbox M1 to an ageing Media HD box and found streaming from my house to my parents' place was reasonably stable, and quality surprisingly high. I did experience the occasional bout of buffering, and sometimes the quality dropped, but by and large the stream was perfectly watchable.

The Slingbox M1 will stream at resolutions up to 1080p if you're using component connections (with composite connections you're limited to standard definition). Just bear in mind that the quality it delivers in real-world use will vary depending on the speed of the connection, in particular at the upload end. In the test above, my uplink speed was 3Mbits/sec, so it clearly doesn't need a huge amount of bandwidth. However, it stands to reason that if your broadband connection isn't reliable or speedy enough, the Slingbox M1 isn't for you.

The remote-control aspect of the system is more hit and miss. To change channels, or browse your recordings, Slingbox's software provides a virtual,

Simply connect the Slingbox to your set-top box to enable streaming

onscreen remote control, which mimics not only the layout, but the exact appearance of your set-top box's remote control. This means it's pretty easy to get to grips with; on my box, however, I found it terribly unresponsive. Clicking buttons to navigate around often involved a lag of between three and four seconds before that action was reflected onscreen.

This makes browsing long lists of recordings or the programme guide a real pain, and fast-forwarding through the ads feels a little like playing pin the tail on the donkey.

More irksome than this is Sling's policy on pricing. The box itself isn't cheap to start with. At US\$149, and priced locally at \$170 from B&H, it's more than four times the price of a Chromecast, and then you have to pay for the apps on top. They're not cheap, either, at around \$20 each. And while the Windows and OS X desktop software is free, it hosts irritating ads when the app's not full-screen.

All of which is a shame, because the hardware does the job as well as can be expected. Remote control is a touch laggy, but given a fast enough internet connection, picture quality is perfectly acceptable. If you're already paying for a comprehensive cable or satellite TV service, it's a great way of making the most of that subscription, and it may be the only way for die-hard sports fans to get their fix when travelling.

If you're tempted by the Slingbox M1, however, I'd advise you ask yourself one key question before you splash out: "How often would I use it?" The answer is unlikely to be enough to justify the \$170 price tag.

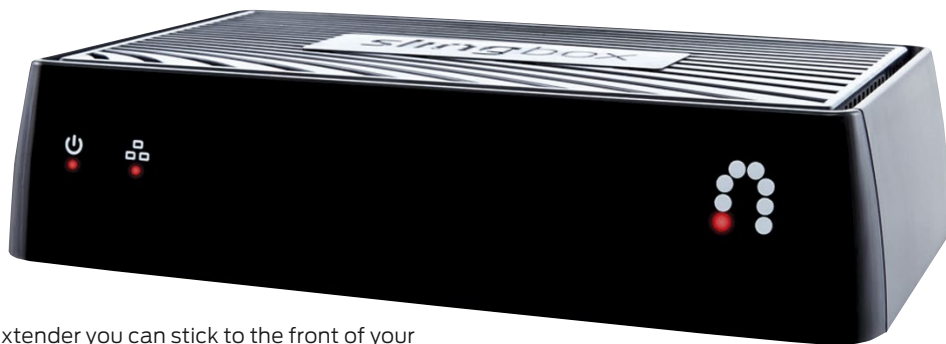
Jonathan Bray

KEY SPECS

\$170 • www.slingbox.com

Up to 1080p resolution • component and composite video out • IR • dual-band 802.11n Wi-Fi • 10/100 Ethernet • 1yr RTB warranty • 179 x 110 x 42mm (WDH)

OVERALL



✓ Video connections are made via composite or component cables



Philips BDM4065UC 4K 40" Display

40 INCHES OF 4K BLISS

There's no denying how stunning 4K panels are, but running such a high resolution on displays smaller than 30 inches is overkill. The screen simply isn't big enough to justify a resolution higher than 2880 x 1800 or so, as pixel structure remains basically invisible at this lower resolution. There's also the issue of 4K requiring a much faster, more expensive GPU to be able to play games at this new super-crisp format. Add the cost of a 4K panel and until now we haven't really been convinced of the benefits offered by 4K PC displays; hooking your 4K PC up to a 4K TV is another matter entirely though. However, this 40 inch behemoth from Philips is a much more convincing argument for the 4K format, as it's actually big enough for the increase in pixel density to make a palpable difference.

The BDM4065UC ships with the standard 4K resolution of 3840 x 2160, but spreads it over a diagonal viewing area of forty inches. This gives it a pixel density of 110 ppi, and at this size it means the Windows desktop is actually readable. This is in stark contrast to the 27 inch 4K panels we've tested in the past, where

the default font size of Windows requires a magnifying glass to read. Of course you can always adjust the font and interface size, but this doesn't work across all applications, making smaller 4K displays somewhat unsuitable for desktop use.

The panel used within is a VA, which is meant to combine the benefits of TN and IPS but has some drawbacks. Specifically, pixel response time can be lower than TN despite looking good on paper, where their black to white times look excellent. The issue crops up when changing between two dark tones, where the response time can lead to ghosting. However, these panels do have a wide viewing angle, and Philips credits this display with having an excellent viewing angle of 176 degrees.



In testing we noticed that viewing angles were decent, although at very close range there was some colour drop-off at the extremities of the screen.

In terms of connectivity, Philips has equipped this display with VGA, 2 x DisplayPort 1.2a, mini-DisplayPort, 2 x HDMI 1.4 and MHL-HDMI. Unfortunately HDMI 2.0 isn't present, but most high-end GPUs come with DisplayPort 1.2a as standard. A four-port USB 3.0 hub is also present. While the range of inputs is admirable, sadly the stand is not. It's possibly due to the large size of the display, or its 9.3kg weight, but the fact remains that the stand is not adjustable in the slightest. That's right – you can't angle it in any direction. As proponents of ergonomic working conditions which require every bit of kit to be adjusted just so, we urge Philips to release a better stand for this display. Twin speakers deliver stereo sound, but they're of the usual horrific quality associated with monitors. Interfacing with the OnScreen Display (OSD) is handled by a small joystick, which we found a tad confusing.

When using the display, we were immediately impressed by the incredible contrast performance – this is one of the best displays for displaying detail in darker areas. Blacks look suitably inky, but the overall colour temperature looked a little cool for our liking. However, screen uniformity wasn't as noteworthy, likely due to the challenges of lighting such a huge panel, and we noticed a slight brightness drop-off in the top left and right corners of the image.

Our biggest concern though was motion blur, and with a pixel response time of 8.5ms it was noticeable during faster games. However, enabling the SmartResponse feature cleaned this up, with Philips quoting a lower response time of 3.5ms. It's still not as blur-free as 1ms displays, but considering the size and price the slight amount of blurring is a low price to pay.

With other 4K panels costing around the same, but ten inches smaller, we have to give kudos to Philips for delivering a 40 inch at such an affordable price. We hate the stand, and the cool image quality might concern colour purists, but when it comes to bang for buck there is no rival.

Bennett Ring

KEY SPECS

\$1033 • www.xxx.philips.com.au

3840 x 2160 resolution • VA panel • VGA, 2 x DisplayPort 1.2a, mini-DisplayPort, 2 x HDMI 1.4

OVERALL





ASUS VivoPC VM62 Mini PC

FULL-FEATURED COMPUTER IN A SMALL FOOTPRINT WITH PLENTY OF CUSTOMISATION OPTIONS.

Small computers are nifty. They can provide a full desktop PC experience where the physical space for a traditional tower case would be cumbersome or impractical. In the past, a tiny form factor meant weak specs and woeful performance -- but the ASUS VivoPC VM62 platform brings compact size and low power consumption together with performance and a reasonable price.

The guts, for all intents and purposes, is a laptop squished into a 19cm x 19cm x 5.6cm rectangle. The VM62 is sold in various configurations through many PC stores thanks to ASUS's large distribution network. The base config is either an Intel i3-4030U or i5-4210U CPU, Intel HD 4400 graphics, 802.11ac Wi-Fi, Bluetooth 4.0 and Gigabit LAN. There's a swathe of ports on the back -- 4x USB 3.0, 2x USB 2.0, HDMI, DisplayPort, an SD card reader and even a socket for a Kensington lock.

Resellers are able to configure the machine with up to 16GB of memory, various disk options and can decide to include an OEM copy of Windows or not. Great if you don't intend to use Windows on the machine.

An excellent piece of ingenuity from the ASUS engineers is a dual bay storage enclosure inside the VivoPC VM62, dubbed the VivoBay. With the VivoBay, you can install a single 3.5" drive or two

2.5" drives, allowing great flexibility with storage. If you want a 6TB HDD and create a versatile NAS, you can. If you want to go with an SSD for your OS and apps and a separate 2.5" hard disk for storing media, you can do that too.

RAM slots and drive bays are easily user accessible, making upgrades a breeze. Thanks ASUS for not taking the same route as Apple's latest Mac Mini and making it a pain in the arse to upgrade simple things like RAM and storage.

The VM62 performs how you'd expect an Intel i3-4030U or i5-4210U CPU would. They wouldn't be your first choice if you're encoding video all day, but for practically anything that isn't too CPU intensive, it works fine. Ditto the Intel HD 4400 graphics. Perfectly fine for anything that isn't gaming or 3D related.

Included is a VESA mount adaptor which enables attaching the VM62 to the back of a monitor or TV with screws. Power is provided by an external adaptor, just like a laptop. An internal power supply like the Mac Mini would be nice.

The VM62 excels as use as a HTPC or home server. Due to the ability to have a high capacity 3.5" drive or two 2.5" drives, it eliminates the need for an external HDD or a NAS if your storage requirements aren't that extreme. Because it's simply an Intel CPU computer, just in a small package, you can run any operating system you like. The VM62 can act simultaneously as a HTPC and a home server too, with plenty of grunt to do both. Install Ubuntu Linux or Windows and configure the server stuff (local file serving, cloud syncing,

automatic downloading, etc) to work in the background, then run Kodi or Plex for TV use.

There are a few other tiny computers on the market. In fact, the competition is even physically smaller than the VivoPC. Intel's NUC and Gigabyte's Brix have a footprint almost half the size of the VivoPC. Specs wise, they're also very similar, with Intel CPUs, HDMI, Wi-Fi and Ethernet ports. Intel's own NUC has a newer generation of CPU, the i3-5010U and i5-5250U and the much improved HD Graphics 5500 and 6000. The NUC is even cheaper than the VivoPC VM62 - with the Intel NUC5i3RYK selling for \$399 without RAM or HDD, versus \$449 for the barebones VivoPC VM62.

The faster CPU and GPU, smaller size and lower price of the Intel NUC make it a better buy over the VivoPC VM62. However, the NUC requires a less ubiquitous M.2 Key Type M SSD for internal storage. The VivoPC VM62's ability to internally house a 3.5" or 2x 2.5" drive may make it more cost effective overall compared to Intel's NUC if the larger size and using the previous generation CPU and GPU aren't an issue.

Anthony Agius

KEY SPECS

Starts at \$449 • www.asus.com.au

Intel i3-4030U or i5-4210U CPU • Intel HD 4400 graphics • 802.11ac Wi-Fi • Bluetooth 4.0 • Gigabit LAN • USB 3.0 • HDMI • Max 16GB RAM & various storage options.

OVERALL



LG G4

LG'S NEW FLAGSHIP TAKES AIM AT THE SAMSUNG GALAXY S6 - AND PULLS OFF AN IMPRESSIVE COUP

Different people want different things from a smartphone. Some value appearance and design above all else. Others want the fastest performance. A fair number, however, value the practical things in life, and it's these folk who will be looking closely at the LG G4: of the current generation, it's the only major smartphone with both a microSD slot and a removable battery. The question is, does the rest of it pass muster?

In its basic shape and controls, the G4 breaks no new ground. The rear is still gently curved and fits in your hand nicely. The volume and power buttons still reside in the centre of the rear panel, just below the camera lens.

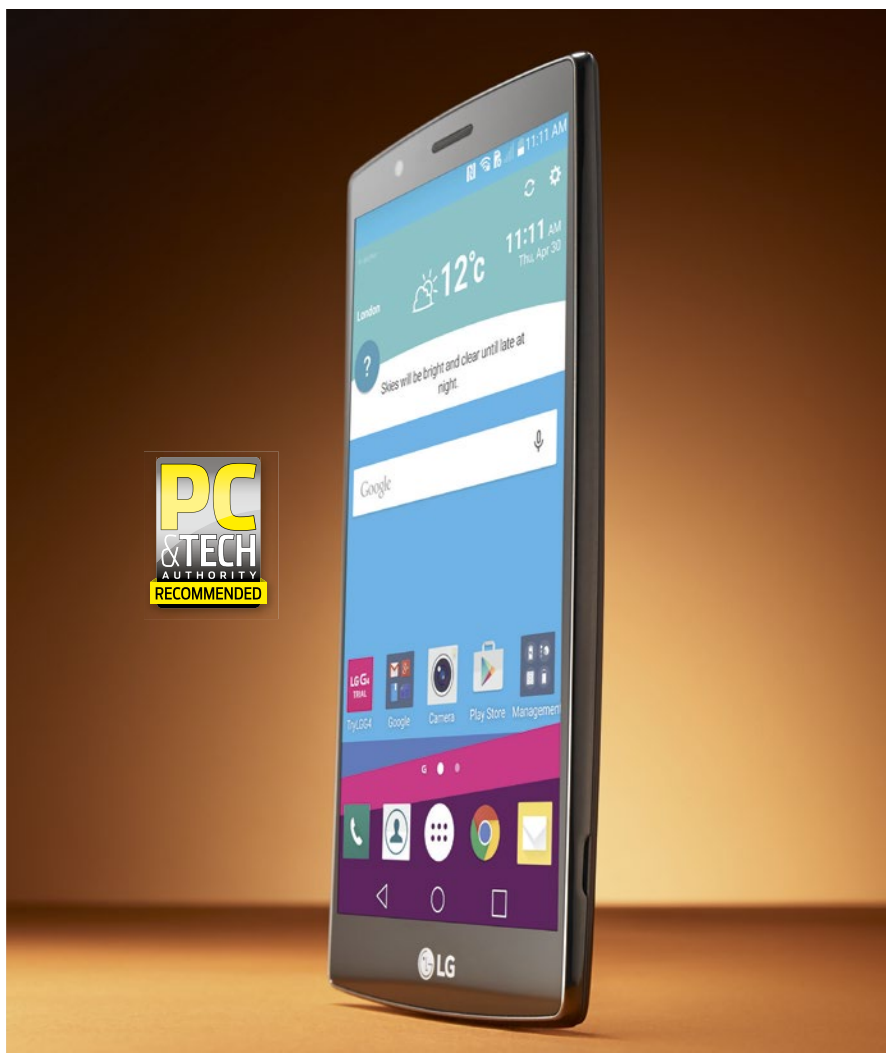
The overall dimensions haven't changed much either. The LG G4 is slightly taller and wider than the G3, at 76 x 9.8 x 149mm, but this isn't as obvious to the naked eye.

One change you might notice is the new "Slim Arc" screen, which curves slightly from top to bottom – a bit like LG's G Flex models, but much subtler. The leather backing is distinctive, too: there's a range of different-coloured designs available, all of which are fetching, with precise, close stitching running down the centre and the G4 logo embossed into the bottom-right corner. Depending on the colour you choose, there's even some variation in the character of the leather, with a smooth, close-grained briefcase finish on the brown and burgundy versions and a coarser grain on the pale blue, black and tan models.

A slightly cheaper range of plastic designs is offered too, in shades including a glossy "ceramic" white and titanium grey, with a subtle diamond pattern moulded into the shell. But we suspect most customers will go for the leather finish, which looks and feels very nice indeed: the black version in particular is fabulous.

SPECIFICATIONS AND DISPLAY

It wouldn't be a flagship launch without a bump in specifications, so it's no surprise to see an upgrade to the internals. But LG is doing things differently from the competition, opting for Qualcomm's six-core, 64-bit 1.8GHz Snapdragon 808 SoC, backed by an Adreno 418 GPU, 3GB of RAM and 32GB of storage. Other specs include dual-band, dual-stream 802.11ac



Wi-Fi with MU-MIMO, Cat9 4G with download speeds of up to 450Mbps/sec, Bluetooth 4.1 and NFC. What you don't get is any kind of waterproofing or wireless charging, but the latter can be added via an optional replacement back.

The CPU's six cores are split in a dual-core/quad-core arrangement, running at 1.8GHz and 1.44GHz. Overall performance compares surprisingly well with the HTC One M9: in the single-threaded Geekbench 3 benchmark, the G4 scored 1,134 versus the M9's 838, and its multi-threaded score of 3,501 was a mere half-step behind the HTC's 3,677 – despite having only half as many cores for intensive tasks.

It isn't all good news. In the GFXBench 3.1 gaming test, the G4 achieved only half the frame rate of HTC's handset – probably in part owing to its high-DPI 1,440 x 2,560 screen, which is more demanding to drive than the M9's 1080p display. It's also worth noting that the Samsung Galaxy S6 easily bested both phones in the Geekbench test, and placed

squarely between the two in GFXBench. But it's possible to get too hung up on such figures: in everyday use, the G4 feels perfectly responsive, and we haven't yet found a game that fazes it.

Elsewhere, battery life is an improvement on last year's G3 – something LG credits to a number of changes, including a more efficient display technology. The G4 uses what LG calls "N-type liquid crystals", which allow more light through so that a lower-power backlight can be used.

In practice, we found that streaming a 720p video in flight mode, with the screen set to a brightness of 120cd/m2, drained the G4 at 6.3% per hour; audio streaming

✓ The camera is one of the G4's great strengths, producing clean, sharp images

over 4G drained it at 3.6%. That doesn't quite match the Samsung Galaxy S6's figures of 6% and 2.8%, but it's better than the HTC One M9 (9.7% and 2.6%). And since the battery is user-replaceable, you have the option of buying a spare, or even a third-party high-capacity replacement.

With a top brightness of 476cd/m², the G4's screen is far from the most eye-searing we've measured, but LG claims that it's capable of producing a wider range of colours than other phones – in conformance to the DCI (Digital Cinema Initiatives) standard, rather than sRGB or Adobe RGB. In practice, we found that the G4 covered 97.9% of the sRGB gamut, which is impressive, and produced a rich tapestry of greens and reds.

The accuracy of those colours is tough to assess, since even with automatic brightness adjustment turned off, the backlight level varies automatically depending on what's displayed onscreen. What we can say is that the LG G4's display has plenty of impact, is as crisp as anyone needs, and produces colours that really leap from the screen.

CAMERAS

Smartphone cameras have been constantly improving of late, and LG keeps pace here: the G4 ups the resolution to 16 megapixels from the G3's 13 megapixels, and widens the aperture to f/1.8, just outdoing the f/1.9 aperture on the Samsung Galaxy S6's rear camera. What this means in practice is that more light hits the sensor, so you can use faster shutter speeds and/or lower ISO sensitivity settings. The end result is sharper pictures with less noise.

LG hasn't stopped there. It's also improved the G3's optical image-stabilisation (OIS) system, adding "Z-axis feedback" this time around. The laser-assisted autofocus from the G3 remains in place too, helping the camera produce sharp photos quickly, while a new colour-spectrum sensor is used to measure ambient light and set the white balance and flash temperature accordingly.

Since the core specifications of the G4's camera are almost identical to those of the impressive cameras on the Samsung Galaxy S6 and S6 edge – both 16-megapixel units with an f/1.9 aperture, 1/2.6in sensor, OIS and phase-detect autofocus – LG's new flagship ought to deliver a decent-quality snap. And that it certainly does: in daylight, photos are well exposed and crisp. The autofocus system works well when shooting from the hip, and general image quality matches the Samsung.

In low light, the G4's camera even beats the S6's in some respects, delivering



sharper, less noisy images, but we found the LG didn't always choose the correct white balance. Under fluorescent strip lights, for instance, white and light-grey shades were tinged with yellow. So much for the colour-spectrum sensor.

Happily, it's possible to rescue such images if you switch to the phone's manual mode and choose to shoot in raw (DNG format) as well as JPEG. This also gives you fine control over shutter speed, white balance, ISO sensitivity, exposure compensation and focus. There's even an auto-exposure lock facility, so you can make sure the settings don't change from one shot to the next. It's a pity that LG doesn't extend this level of control to video capture, which is fully automatic.

Meanwhile, the front camera, as is the current trend, is a high-resolution, 8-megapixel unit, and a host of enhancements have been made to the camera software. We like the way you can now double-tap the volume-down button while the phone is in standby to open the camera directly and take an instant shot.

There's also a rather gimmicky "gesture interval shot" selfie mode. Simply put, this lets you take a sequence of shots two seconds apart by opening your hand and clenching your fist in front of the camera a couple of times.

NEW SOFTWARE FEATURES

Predictably, the G4 brings a raft of updates to LG's custom UI overlay, which runs on top of Android 5.1. None of these is particularly groundbreaking: the biggest new feature is the Smart Bulletin service, which – with a swipe left from

< The plastic-backed models have a clean style and a slightly lower price

the homescreen – brings up a card-based view presenting notifications from a handful of preset apps, such as LG's Health app, the calendar, the QRemote app and a few others. You can customise the view by dragging elements around and enabling or disabling various services, but you'll probably just want to turn the whole thing off.

LG has also upgraded the Gallery app: it now has a feature called "Memories", which automatically organises your photos and videos into event-based albums – a bit like Google Photos does with its Stories feature, only offline. Potentially more useful is the "Timeline" feature, which brings up an overview of all the photos you've taken in a given day, month or year, as a stream of tiny thumbnails in one or several large blocks.

LG's Google Now-esque "Smart Notice" system has been improved too: now, purportedly, it has the ability to learn from your "lifestyle and usage patterns". We're not convinced by this: during our testing it seemed mainly to present weather-based advice, such as "It will rain today starting in the afternoon. Be careful on the road." This particular gem was delivered on a day when I'd travelled by train to work.

VERDICT

While we're not bowled over by the software, it hasn't dampened our enthusiasm for the LG G4. It's incredibly hard to be different in the smartphone world, but with some bold design choices LG has managed to pull it off.

Critically, it hasn't compromised performance, battery life or camera quality, and retaining both a microSD slot and a removable battery means the G4 will appeal to a whole tranche of customers for whom flexibility is most important.

So, while the Samsung Galaxy S6 remains the price-no-object smartphone of choice, the LG G4 is a great option for everyone else. It's a stylish, capable smartphone, and one that – refreshingly – does things a little differently.

Jonathan Bray

KEY SPECS

\$929 (\$869 for plastic-only cover) • www.lg.com.au
Six-core 1.8GHz/1.4GHz Qualcomm Snapdragon 808 SoC • 3GB RAM • 32GB storage • microSD slot • 5.5in 1,440 x 2,560 IPS display • 16MP/8MP front/rear cameras • 802.11ac Wi-Fi • 4G • 3,000mAh Li-ion battery • Android 5.1 (Lollipop) • 1yr RTB warranty • 76 x 9.8 x 149mm (WDH) • 155g

OVERALL



Labs Briefs

Kingston HyperX Cloud II

\$149 • www.kingston.com

Two huge 53mm drivers in the HyperX Cloud II provide excellent sound quality and not just for the price range. The full range of sound is excellent, all the way from the punchy bass through to the clear treble. In addition to the standard 3.5mm jack that makes the Cloud II a suitable headset for nearly any audio device, the headset also comes with a USB virtual 7.1 soundcard that also features simple in-line controls. The 7.1 virtualisation is good for the most part, with Kingston's software generally doing a good job working out from which direction each sound originates, but the overall audio quality takes a little bit of a hit, becoming slightly less defined than a straight stereo input.

The detachable microphone is also excellent, with the USB soundcard providing external noise cancelling, volume monitoring and normalisation as well as echo cancellation.

Daniel Wilks



OVERALL



SanDisk Ultra Dual USB Drive 3.0

\$69 (64GB), \$39 (32GB), \$29 (16GB)
• www.sandisk.com/dualdrive

This is not a complicated product. It's simply USB storage, but with a regular USB 3.0 plug on one end, and a microSD plug on the other, and it's OTG-enabled. In between the two connectors, within its 3cm long body, is 64GB of storage (16 and 32GB also available).

The idea is that it's your new tool for transferring data between devices, and that would primarily be smartphones to tablets to PCs, a task that should be straightforward but often involves annoying apps or clouds. It's also handy dandy to use as a plain old USB drive, with the utility of having dual connectivity options.

If simple dragging and dropping is a bit of a chore, SanDisk has its Memory Zone app which works with this. Its UI is good looking and simple, and offers a great at a glance overview of your device's storage.

Ben Mansill



OVERALL



Imation Link Power Drive

www.imation.com • \$119 (16GB), \$149 (32GB), \$189 (64GB)

This palm-sized 110g minibrick has a 3000mAh battery, and functions as a portable power source for your mobile devices. It also has onboard memory for data storage, which is its big appeal. So, it's a cross between a battery and a USB drive. That's some party trick and its usefulness is greater than the sum of its two functions.

You do pay for the convenience; however, as you would be paying roughly half the cost of this for a regular power brick of similar capacity and a separate USB drive. Annoyingly it's only USB 2, but that's supplemented by a Lightning connector, so I suppose that sort of evens it out.

It's also Mac-only at this stage. An Android version hasn't been confirmed by Imation at the time of writing. So, for now, there's just this.

Ben Mansill



OVERALL



Steelseries Siberia V3

\$99 • www.steelseries.com

Similar in design to the great Steelseries Siberia V2 headset as well as the pricier V3 Prism, the V3 headset features two large ear cups connected with a structural band and a floating head strap that sits the headset lightly and comfortably in place. As far as design goes, the Siberia V3 is a winner. It looks great and is extremely comfortable to wear. It's also equally good when it comes to sound quality. Like the V2, the Siberia V3 has a flattened EQ which means that there isn't the bass enhancement you find in the majority of gaming headsets. The 50mm drivers provide excellent audio through the mid to high ranges but lack a little bit of oomph when it comes to the bass. For the most part this isn't hugely noticeable, but does become a little bit of an issue when playing bombastic games like CoD or Wolfenstein.

Daniel Wilks



OVERALL



Antec GX300

\$80 • www.antec.com

This is the second budget Antec case we've seen in recent months, and while GX900 comes in black and military green, with black and yellow hazard stripes around the front fascia, the GX300 is altogether more traditional. It's plain black, with some design flourishes that set it apart, but for the main it's very workmanlike – in a good way!

With two fans bring air in, and one taking it out, it keeps positive internal pressure, which is great for keeping your system dust-free. The slight rise to the front panel also helps this. There's a drive cage which can be configured for any size of drive, or stripped down to make more room, though not a lot of space for cable management. With a windowed side-panel, it's also great for those who want to show off their parts. And for the price – we like it.

David Hollingworth

OVERALL



Leica Q

\$5900 • www.leica-camera.com

Leica's newest addition to their line up is a stunning rangefinder-styled camera sporting a Summilux 28 mm f/1.7 ASPH. lens and a 24MP full frame CMOS sensor, that together produce truly beautiful, sharp images. The Leica Q also features an industry leading integrated electronic viewfinder with a resolution of 3.68MP, making capturing fine details, framing and exposing correctly a breeze.

Once you starting shooting with the Q, you fall even more in love with it. Not only does it look and feel amazing in the hand, its performance and usability is as exciting as its looks. Incredibly fast focus, the option to shoot at 28mm, 35mm or 50mm, macro shooting at just 17cm, good high ISO performance, touch screen focusing and an easy to use smartphone app are just a few of the Leica Q's features that make using this camera a real treat.

The only downside is the price, at \$5900 it's expensive for a street photography-style camera, but it really is an amazing camera that looks and performs extremely well.

Tim Frawley

OVERALL



Roccat Apuri

\$39 • www.roccat.org

This sexy little desk scorpion is a mouse bungee and powered USB hub in one, we must say, very attractive form. I saw this at Computex at the Roccat stand, and rudely zeroed in on it, temporarily ignoring the more... important products from Roccat. It looks sensational on a desk, with that lovely rubbery plastic texture and blue lighting to make it stareworthy. Passersby, too, will stop and gape, before asking what the heck it is.

The actual utility value of mouse bungees all depends on how you mouse, and what you mouse with. Twitch gamers love them, as do a couple of graphic designers here in the building, all because they raise the mouse cable and make the mouse itself feel like it's gliding free like the wind, or like a wireless mouse. The four USB ports are only USB 2, but they are powered.

Ben Mansill

OVERALL



Cougar 200K

\$39 • www.cougargaming.com

Lower in the food chain than the mechanical keyboard, but a notch higher than the old-style membrane keyboard sits the scissor keyboard. Its mechanism also strides both types, with a longer and springier movement than membrane offers, but still well short of the long throw and decisive actuation a mechanical offers.

Priced at under forty bucks, this Cougar 200k is also a good deal cheaper than any mechanical keyboard. While it's pitched at gamers, and does support anti-ghosting in 19 of its keys, the 200K would also be a decent upgrade for regular use, but only if your existing membrane keyboard is past its prime and you're not writing a novel. I didn't like the spacebar, which had a very loose and rattling clacking feel, and I wouldn't want to type for longer than half an hour on it due to the low-set keys.

Ben Mansill

OVERALL



Extend your Wi-Fi

YOU DON'T HAVE TO BUY A NEW ROUTER TO KILL DEAD SPOTS IN YOUR HOME NETWORK: AN EXTENDER CAN DO THE JOB FOR LESS



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Whether in the home or in the office, Wi-Fi connectivity is now crucial. We're using it to hook up laptops to the internet for work and play; to connect our tablets, set-top boxes and smart TVs to our favourite streaming services; to keep our mobile devices online and our apps continually updated.

Like electricity, we notice the network most when it's not there, and just as nobody wants a room without a plug socket, so we now want Wi-Fi everywhere, in the office and around the house. In fact, we're coming to expect Wi-Fi connectivity outside as well. We want to be able to sit in the garden and still receive our email, listen to Spotify, stream movies via Netflix and browse the web.

But there's a problem. For most people, the key part of all this wondrous

connectivity – the humble wireless router – must be located near the fixed point where the broadband connection enters the building, and this may not be the best position from which to spread Wi-Fi throughout the house. What's more, neighbouring Wi-Fi networks can affect range and performance.

So what's the best way to fix this? You can upgrade your router to a more capable model supporting the latest 802.11ac standard and ensure you make the most of the 5GHz spectrum, which is less cluttered, but this solution is no guarantee of a decent connection everywhere. Not every device supports 802.11ac or the 5GHz band, and the higher frequency itself isn't a silver bullet, since it typically has a more limited range than 2.4GHz and is often affected by intervening barriers.

This is where wireless extenders come in. They take the signal from your router and spread it outwards from a new location, improving coverage and ensuring connectivity where you need it most. Best of all, they're usually cheaper than upgrading to the latest, greatest new-model router.

CHOOSING AN EXTENDER

Mainstream Wi-Fi extenders come in two main forms. First, you have repeaters: these take the Wi-Fi signal broadcast by your router and extend it outwards, while taking the Wi-Fi signal from connected devices and then sending it back the other way.

They come in single-band 2.4GHz and dual-band 2.4GHz and 5GHz varieties, not to mention variants of the latest 802.11ac standard, including AC750,



Caption font

out at 867Mbps/sec while running an 802.11ac network in the 5GHz spectrum, with a further 300Mbps/sec available simultaneously over the 2.4GHz band.

POWER TO THE PEOPLE

The alternative is a powerline extender kit. Here, one unit connects to your router via Ethernet, and uses your mains electricity cabling to extend the wired network to a second device that plugs in where you need connectivity. In a straight powerline implementation, the latter has an Ethernet port for your PC, but wireless extender kits add an access point so wireless devices can connect.

It sounds like the ideal solution, but as with wireless extenders, you need to be aware that there are some major limitations. There's a big and not unjustified hoo-ha about how

powerline networking can create radio interference, spoiling things for amateur radio enthusiasts. And whether or not you achieve usable speeds depends on the age and health of your mains cabling. Still, given ideal circumstances, it can be an effective way of getting a signal to places where even the most powerful extenders can't reach.

There are a few key points to note here. First, a repeater won't give you faster Wi-Fi than your existing router; connect an AC1900 extender to an 802.11n router and the connection to your original network will still only be at 802.11n speeds.

Second, the quoted speeds are theoretical maximums. Whether you're talking about 500Mbps/sec powerline or 867Mbps/sec 802.11ac, it's unlikely you'll ever reach those figures unless you're connecting from only a few metres away

in near-perfect conditions. The fact that a repeater or extender will usually be further than a few metres from your router, with a further gap between it and your device, only makes those speeds more unreachable.

Third, the vast majority of repeaters are hamstrung by the vagaries of Wi-Fi itself. Unlike Ethernet, Wi-Fi is a half-duplex networking technology; a device that's transmitting can't receive at the same time, so each transceiver on the network alternates rapidly between the two. A repeater then has to repeat each transmission, adding another step to the communication.

The end result is that, most of the time, a connection using a repeater will be significantly slower than one made direct to a router. However, some of the more recent 802.11ac extenders mitigate this

	RECOMMENDED			RECOMMENDED	
	Asus RP-AC52	D-Link DAP-1520	Linksys RE4100W	Linksys RE6500	
OVERALL	★★★★☆	★★★☆☆	★★★★☆	★★★★☆	
Pricing					
Price	\$120	\$129	\$105	\$130	
Site	asus.com.au	dlink.com.au	linksys.com	linksys.com	
Warranty	3yr RTB	2yr RTB	1yr RTB	1yr RTB	
CORE SPECIFICATIONS					
Standard	AC750	AC750	N600	AC1200	
Maximum rated link speed 802.11ac/n	433/300Mbps/sec	433/300Mbps/sec	N/A / 300Mbps/sec	867/300Mbps/sec	
Dual-band	✓	✓	✓	✓	
MIMO stream configuration 802.11ac	2x2	2x2	2x2	2x2	
MIMO stream configuration 802.11n	2x2	2x2	2x2	2x2	
Antenna placement	Internal	Internal	Internal	External	
LAN ports	10/100	✗	10/100	3 x Gigabit Ethernet	
USB/eSATA ports	✗	✗	✗	✗	
Beamforming	✗	✗	✗	✗	
256-QAM on 2.4GHz	✗	✗	✗	✗	
SECURITY & SETUP					
Security types	WPA2; WPA	WPA2; WPA	WPA2; WPA	WPA2; WPA	
Parental controls	✗	✗	✗	✗	
WPS button	✓	✓	✓	✓	
Positioning assistance	✓	✓	✓	✓	
Browser-based setup	✓	✓	✓	✓	
Use existing SSIDs/create new SSIDs	optional / ✓	optional / ✓	✓ / optional	✓ / optional	
Access point mode	✗	✗	✗	✗	
PHYSICAL FEATURES					
Power switch	✓	✗	✓	✓	
Dimensions (WDH)	54 x 31 x 85mm	58 x 34 x 92mm	68 x 64 x 102mm	152 x 107 x 28mm	
Ethernet cable supplied	✗	✗	✗	✓	
Additional features	Audio streaming; LED nightlight; touch panel	✗	✗	Audio streaming	

by using both the 2.4GHz and 5GHz Wi-Fi bands, receiving data on one and pushing data out on the other. This helps them maintain higher speeds.

Antennas also play a critical role. Whether internal or external, each extender will have an array of antennas, each one providing a stream over which it sends or receives data, with more streams equating to more bandwidth. The speed of an extender is to some extent defined by the number of antennas, and by their size and signal gain. An AC1750 router, for instance, must have three antennas.

Finally, positioning is crucial. In an ideal world, you'd place a wireless extender halfway between your router and your target device with a steady, strong signal from both; in the real world, this is difficult to achieve, what with the average house or flat having to contend with walls, floors

and other sources of RF interference and attenuation. What you need, then, is to find the optimal position. We did a lot of experimenting before and during testing, and found that moving the extender from one position to another could see speeds drop by more than 50%. As a general rule, the closer you position the extender to the router the better, even if it makes the onward connection slower.

Some extenders have built-in indicators to help you get the best position, or work in concert with a dedicated smartphone app to do the same.

Third-party Wi-Fi monitor apps for smartphones and tablets can also help you find the best position to locate your extender for best results.

FURTHER CONSIDERATIONS

Extenders vary in terms of features. Some

offer basic Wi-Fi only, while others include multiple 10/100 or Gigabit Ethernet ports, wireless audio-streaming features or an access point mode, where it can plug into your existing router and replace or enhance your Wi-Fi network.

Some go even further, with USB print and file server functions. These may seem like overkill, and not the kind of thing you want from a little box in your living room or spare bedroom, but they could make your Wi-Fi network more useful.

Finally, consider the form factor. The majority of extenders and almost all powerline kits are all-in-one units that plug directly into a mains socket. This keeps them neat and unobtrusive. However, models with a separate power supply have an advantage in that you can move the extender around to get a better signal and avoid signal-spoiling obstacles.

LABS WINNER					
Netgear Nighthawk AC1900 Extender	Netgear WN3000RP	TP-Link RE210	Trendnet TPL-410APK	ZyXEL WRE6505	
★★★★★	★☆☆☆☆	★★★★☆	★☆☆☆☆	★★★★☆	
\$298	\$99	\$78	\$133	\$71	
netgear.com.au	netgear.com.au	tp-link.com	trendnet.com.au	zyxel.com.au	
2yr RTB	2yr RTB	3yr RTB	2yr RTB	2yr RTB	
AC1900	N300	AC750	N300	AC750	
1,300/600Mbps/sec	N/A / 300Mbps/sec	433/300Mbps/sec	N/A / 300Mbps/sec	433/300Mbps/sec	
✓	✗	✓	✗	✓	
3x3	2x2	2x2	2x2	2x2	
3x3	2x2	2x2	2x2	2x2	
External	External	External	Internal	Internal	
5 x Gigabit Ethernet	10/100	Gigabit Ethernet	2 x 10/100	10/100	
USB 3	✗	✗	✗	✗	
✓	✗	✗	✗	✗	
✓	✗	✗	✗	✗	
WPA2; WPA	WPA2; WPA	WPA2; WPA	WPA2; WPA	WPA2; WPA	
✓	✗	✗	✗	✗	
✓	✓	✓	✓	✓	
✓	✓	✓	✗	✓	
✓	✓	✓	✓	✓	
optional / ✓	optional / ✓	✓ / ✓	optional / ✓	optional / ✓	
✓	✗	✗	✓	✓	
✓	✓	✓	✓	✓	
174 x 31 x 252mm	55 x 34 x 67mm	75 x 54 x 94mm	58 x 59 x 70mm / 70 x 65 x 100mm	62 x 47 x 91mm	
✗	✗	✓	✓	✓	
DLNA server; printer sharing	✗	✗	✗	✗	

What's the most effective way to boost your network?

KILLING DEAD SPOTS, EXTENDING YOUR RANGE, BOOSTING SPEEDS - THERE ARE MANY REASONS TO UPGRADE YOUR HOME OR SMALL-OFFICE NETWORK. WE EXPLAIN HOW

Stronger signals and longer range might be at the heart of many home and small-office network upgrades, but more of us are pushing our networks harder than ever before.

Not only do we have more connected devices at home, but those devices are demanding more bandwidth. It's true to say that, with services such as audio and video streamers, Skype and cloud-based applications, your broadband connection is a more likely bottleneck than the 802.11n connection to your router.

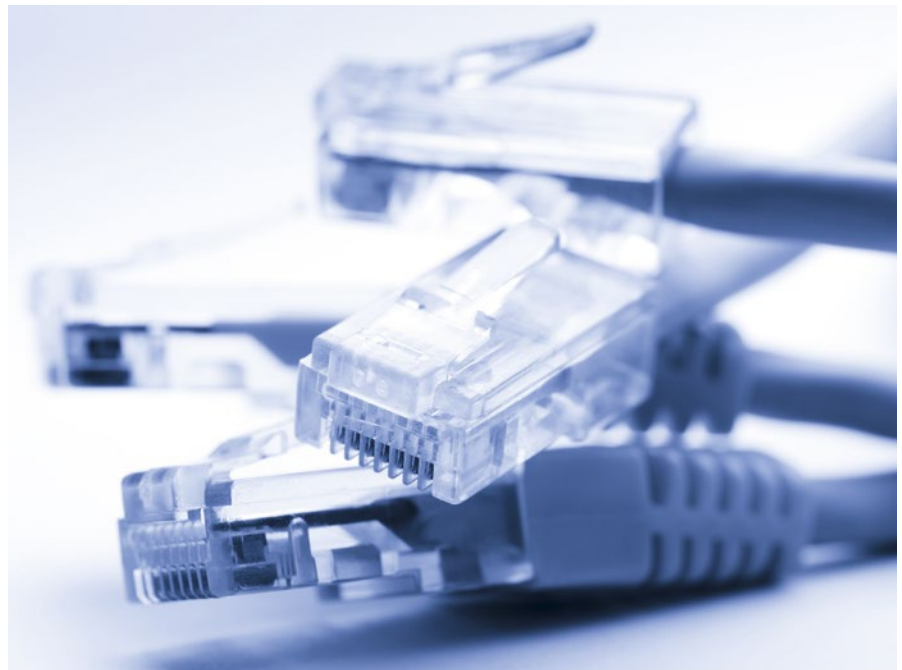
But what if you have several of these services running concurrently, or you want to stream HD or 4K video inside the home? What if you want to try streaming between a gaming PC or console and a lightweight laptop or tablet – already an option with Steam and the PlayStation 4, and coming soon to the Xbox One?

If you're running up against the limitations of your network – either in terms of speed or range – then you have several options. Here's how they all stack up.

INSTALL A WIRED NETWORK

The ideal way to set up a future-proofed network for high-bandwidth applications is to use good old Ethernet. Gigabit Ethernet ports are now built into many laptops and PCs, and Ethernet is still the best route for optimal performance from media streamers, NAS drives, games consoles and the like. You get full-duplex performance and a guaranteed speed independent of distance, and your existing router may already have Gigabit ports built in. If not, you can connect an affordable Gigabit switch. You'll only find the 100Mbps/sec connection on your router a bottleneck when traffic moves from the local network out to the internet; your PCs, storage devices and media streamers can still communicate with each other at Gigabit speeds.

The downside is that installing a wired network is a lot of work, and if you don't have an easy way to run the cabling through walls and floors, then you may need to call in an electrician. And while the cabling itself doesn't have to be expensive – 100m of unshielded CAT-5e or CAT-6 can be had for \$50 to \$100 – you'll also need Ethernet wall plates,



back boxes and socket modules to finish the job. For some households the investment in time, money and effort will be worth it, but not all.

POWERLINE

Powerline networking piggybacks a data connection on your existing mains cabling, and is an easier and relatively affordable way to set up a hardwired, point-to-point connection. You can now buy 500Mbps/sec kits for less than \$100, with single units cheaper still. New models push maximum speeds up to 1.2Gbps/sec and 2Gbps/sec, with wireless access points (APs) that support the newer 802.11ac standard. Powerline is ludicrously easy to configure, and usually faster and more reliable at a distance than a conventional Wi-Fi network. In situations where Wi-Fi lets you down, powerline may be able to deliver.

As we mention elsewhere, though, powerline speeds should be taken with a pinch of salt. Performance will degrade over distance, and the quality of your household power cable and interference from other appliances and devices connected to the mains also affects

speed. What's more, many 500Mbps/sec devices only offer 100Mbps/sec Ethernet ports, meaning that even with an optimal connection, 100Mbps/sec is as good as things will get.

That said, powerline speeds can compare favourably with 802.11ac extender speeds. Alongside the wireless extenders, we tested a straight powerline kit – the TP-Link AV1200 – and found it reached speeds of 28MB/sec in our mid-range tests and 5MB/sec to our remote garden office. Only the Labs-winning Netgear Nighthawk AC1900 was able to establish a connection in the latter location.

There are reasons to avoid powerline, however. Ham radio enthusiasts hate it, because the equipment generates a radio signal that interferes with some available radio bands. What's more, there are reliability issues with some powerline kit. *PC & Tech Authority* contributor Paul Ockenden has written about the failure rate of some adapters (tinyurl.com/pg82wqh), and anecdotal evidence suggests that if a powerline product stops working, no amount of reconfiguring and synchronising can get it to work reliably again.



Failures to sync can also result in annoying trips around the building, and sometimes two units from the same manufacturer will suddenly fail to connect. This doesn't make powerline a bad solution, but you need to keep that in mind.

WIRELESS EXTENDERS

We won't say too much about extenders here in a Labs that's devoted to their testing, but they're not a miracle fix for an ageing network. You'll always be limited by the speed of your existing Wi-Fi network, so even if your laptop or Wi-Fi adapter supports 802.11ac, as does your chosen extender, the connection between the extender and an 802.11n router will be a bottleneck.

What's more, your range may be limited by the fact that the extender usually needs to stay quite close to the existing router. Extenders excel in two areas: stretching the wireless network so that it covers unserviced areas of the home – albeit usually at reduced speeds – and expanding the reach of a high-speed 802.11n or 802.11ac network so that you can still attain exceptional speeds in an adjacent or nearby room.

WIRELESS ACCESS POINTS

If you're more concerned about improving speed than extending the range of your network, then a new wireless AP could be the answer.

Connecting to your router through a Gigabit Ethernet connection, it's possible to augment or replace a router's existing wireless network with a new one, based on a faster standard. In this way, you can upgrade to 802.11ac without ripping out

▲ Powerline kits can often reach areas that Wi-Fi extenders can't existing hardware.

Wireless APs are often designed to cope with more simultaneous connections, improving network performance in a home brimming with smartphones, tablets and wireless media streamers.

The downside? They can be expensive, sometimes more so than a router of the same standard with more features. In fact, many routers can be switched to an access point mode, while some wireless extenders can work as an AP instead. If you're tempted, check that there isn't an extender or router that could handle the same job for less.

A NEW ROUTER

Arguably, the most positive move you can make is to buy a new router. The 802.11ac market is maturing nicely, and it's easy to find an affordable model that will net you faster speeds and better range. The Netgear R7500 Nighthawk R4 or the low-cost D-Link DIR-

> Buying a new router (such as the Netgear R7500 Nighthawk R4) may be the best way to increase speeds

868L can provide speeds in excess of 75MB/sec at close range and 45MB/sec at distance. There's a possibility that former Wi-Fi dead zones might open up for business.

Again, you need to be realistic. Connections on the 5GHz band suffer less from interference, but struggle more

“The ideal way to set up a future-proofed network for high-bandwidth applications is to use good old Ethernet”

to penetrate walls and cover longer distances than those on the 2.4GHz spectrum.

You may be able to establish a connection in the distant corners of your home, but without an extender it might not be particularly speedy. In the location of our mid-range test, we struggled to achieve speeds of more than 1MB/sec using only a direct connection to an AC1900 router. With the Netgear Nighthawk AC1900 working, we reached 20.2MB/sec. On the other hand, a shorter-range test through 8m and two brick walls saw the router hit 29MB/sec versus the extender's 24.6MB/sec.

Finally, it's worth remembering that simply adding an extender or upgrading a router won't necessarily enhance range or performance unless you invest in additional network kit. If your laptop or PC doesn't support 802.11ac, you'll need new adapters, and neither USB adapters nor PCI Express cards come cheap.



Linksys RE6500

NOT THE FASTEST IN ALL SCENARIOS, BUT A VERSATILE EXTENDER THAT'S PACKED TO THE BRIM WITH FEATURES

There are two things that might put you off the Linksys RE6500. The first is that it's a little more expensive than most 802.11ac extenders, coming in at around \$130. Second, it isn't a neat all-in-one unit that plugs into a mains socket, but a device that looks a little like a scaled-down router, complete with its own power supply.

On the first point, we'd argue that the RE6500's features and performance make the extra expense worthwhile. On the second, it's still very compact and discreet, while the separate power supply gives you valuable flexibility on positioning. Place it on a bookshelf or windowsill or, better still, mount it on a wall, and you'll probably get a better signal than rivals stuck in a plug socket down near the floor.

In terms of features, the RE6500 comes second only to the Netgear Nighthawk AC1900. It's an AC1200 extender, giving you up to 300Mbps/sec of bandwidth on the 2.4GHz band and up to 876Mbps/sec over 5GHz, and both are available concurrently.

This is supported by a 2x2 antenna array and cross-band technology, allowing the RE6500 to receive on one band while transmitting on another for faster speeds than a conventional half-duplex Wi-Fi connection.

In addition, it has four Gigabit Ethernet ports and a 3.5mm audio output. Connect a pair of speakers or some headphones and you can stream music to the extender as if it were a Windows Media Center Extender or a DLNA-compliant media player. It's nowhere near as slick as a Sonos system, but it's a simple, functional way of playing music from a



tablet, smartphone or laptop.

Setup could be easier. Linksys' quick-start guide covers connecting to the RE6500's temporary network and running through the configuration wizard, but there's no mention of how to configure WPS, which the RE6500 does support.

The login page opened first time on Internet Explorer, but it wouldn't open in Chrome without the extender's URL being manually entered. WPS works perfectly well, but we found that having the same SSIDs in play for both the router and extender seemed to lead our test machine to connect direct to the former rather than the latter – a problem we didn't encounter with other extenders. With different SSIDs in place, everything worked fine.

There's precious little help available for positioning, either. The box talks of a configuration app, but we couldn't find it on the Apple App Store or Google Play, and it isn't mentioned in the quick-start guide either. The guide simply tells you to place the RE6500 halfway between your router and your PC or device, which isn't always the ideal location for an extender: you may need to place the device closer to the router to get a reliable connection. The only indicator on the device (aside from the Ethernet socket LEDs) glows

▲ The Linksys looks a little like a scaled-down router steady when the extender has a solid connection and pulses when it doesn't.

The good news is that none of these niggles is a deal-breaker. With a little experimentation, we managed to find effective spots for both our tests, and if you're struggling, third-party Wi-Fi analysis tools can help. The RE6500 was a consistently good performer in our mid-range tests, scoring just behind the Netgear, Asus and ZyXEL AC extenders in the 5GHz band and ahead of the latter two for 2.4GHz 802.11n. What's more, the RE6500 held up better in our long-range tests, where it jostled with the Nighthawk for supremacy.

It might not be the last word in speed, then, but this isn't always the most important consideration when choosing a wireless extender.

For features, long-range solidity and value, this is the best mainstream extender on test.

▼ A 35mm audio output allows you to stream music to the extender



KEY SPECS
\$130 • www.linksys.com

OVERALL



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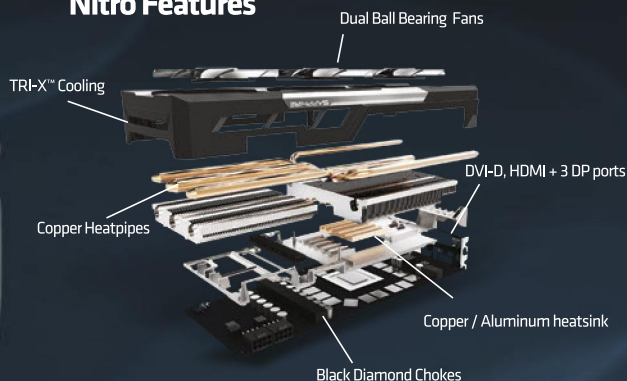
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Netgear Nighthawk AC1900 Extender

SUPERB FEATURES AND PERFORMANCE JUSTIFY THE NIGHTHAWK'S PREMIUM PRICE

Even the most cursory glance will tell you that the Netgear Nighthawk AC1900 is no ordinary wireless extender. For a start, it looks more like a router, with a 252 x 174mm footprint and three sizeable antennas sticking out at the back. You can use it in its horizontal orientation or place it vertically on the supplied stand, but either way it's a formidable piece of networking kit, with a distinctive, angular design.

What's more, that design has been thought through. The single USB 3 port is accessible at the front, with five Gigabit Ethernet ports around the back. Admittedly, it's a little odd that the WPS button is smaller than the power button and located on the rear, but you'll need it only when adding new devices to the network.

To call the Nighthawk AC1900 Extender (model number EX7000) highly specified would be an understatement. For a start, it supports the high-end AC1900 variant of 802.11ac, giving you up to 1,300Mbps/sec of bandwidth on the 5GHz band and up to 600Mbps/sec on the 2.4GHz band, provided you have a TurboQAM-compatible wireless adapter with a 3x3 antenna array. These are still in short supply, however, with only PCI Express desktop cards available at the time of writing. The antennas are also SmartBeam-compliant, so the extender can focus its available power for additional speed at longer range.

Then we come to the features. A single USB 3 port supports printers

> As well as fast wireless, the Nighthawk has five Gigabit Ethernet ports



and external hard disks, with the option to use the Nighthawk AC1900 as a DLNA-compliant media server. Gigabit Ethernet allows you to connect smart TVs, media streamers, NAS drives and games consoles to the extender and make the most of its connection speeds. You can use the extender as an access point, replacing your existing wireless network, and the configuration options even stretch to such advanced features as parental controls.

Setup is almost flawless, with a well-designed, easy-to-follow wizard that guides you through finding your existing networks, and building and securing the 2.4GHz and 5GHz extended networks. Our only complaint, and it's a minor one, is that you're forced to sign up with an email address and password – an unnecessary step for a hardware installation.

Positioning the router is also very easy. Both the 5GHz and 2.4GHz bands get their own small signal-strength meter, and you can plug in the Nighthawk AC1900 and move it around until you achieve acceptable levels. One advantage of this extender's sheer power is that it's much less fussy about placement than some of its rivals. Move it further away from your router and it still holds a stable link.

Performance is exceptionally

▲ The distinct, angular design has been well thought through

good. Even on the 2.4GHz band we hit speeds of 12.8MB/sec in our mid-range tests, with that increasing to 17.9MB/sec and a storming 20.1MB/sec with 5GHz 802.11n and 802.11ac connections. And while these speeds fell in our long-range tests, they were still acceptable and ahead of any rival extenders.

What's more, the Nighthawk AC1900 was the only extender to get a stable signal down to a remote outside office on our premises, maintaining a speed of 5.2MB/sec. Frankly, it's wasted on simply stretching a wireless network to the back garden, but if that's what you want, it's more than capable of the job. Just be aware that its full 802.11ac speeds still only really apply at close to medium range. On the same floor as our router, across 8m of distance and through two brick walls, we could transfer files at a speed of 25.6MB/sec; not as fast as a direct connection to the router (29MB/sec), but not far behind.

KEY SPECS

\$298 · www.netgear.com.au

OVERALL



Vigor2925ac

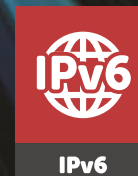
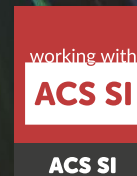
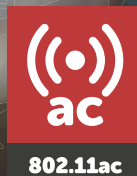
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Asus RP-AC52

A VERSATILE, COMPACT EXTENDER THAT'S EASY TO POSITION AND DELIVERS SOME HANDY EXTRA FEATURES

While some extenders are happy to compete on price and performance, Asus is focusing on product design and innovative features. On paper, the RP-AC52 is just another wall-plug AC750 extender with built-in Ethernet, but it has a compact, angular design and interesting, pseudo-quilted finish to distinguish it.

You also get audio-streaming features and a built-in nightlight, activated by a configurable touch panel at the front. Plus, if a soft glow doesn't do it for you, you can also connect the RP-AC52 via Ethernet to a wired network and use it as a wireless access point.

Not all of these features work brilliantly, however. The Ethernet is 10/100 rather than Gigabit, while audio streaming requires Asus' own AiPlayer Android app for streaming tracks from local and network sources, which must be DLNA-compliant. You can get radio if you install the XiiLive internet radio app, but this is a paid-for extra.

Setup isn't the RP-AC52's strong suit, either. Asus' browser-based routine feels a little clunky in comparison to that of TP-Link and Linksys, although you can use WPS. By default the extender assigns new SSIDs with "RP" suffixed, but you can simply replicate the existing SSIDs if you wish.

Locating your extender is a different story. Blue bars stretching left and right of centre indicate 2.4GHz and 5GHz signal strength respectively, delivering a smart, at-a-glance impression of whether your extender is in the right place, too close or too far away.

Luckily, performance is pretty good. The Asus hit a respectable 14.5MB/sec on the 802.11ac network in our mid-range test, and still delivered credible results across the 2.4GHz and 5GHz bands in the long-range test.

For performance and features, we'd opt for the Linksys RE6500, but if you want a versatile, almost-pocket-sized extender for the home or office – one you



can plug in and forget – then the RP-AC52 could be for you.

KEY SPECS

\$120 • www.asus.com.au

OVERALL



Trendnet TPL-410APK

A FUNCTIONAL POWERLINE EXTENDER KIT, BUT IT ISN'T PARTICULARLY SPEEDY OR EASY TO SET UP

The most appealing thing about the Trendnet TPL-410APK is, unquestionably, its price. For £44, you get a two-part 500Mbps/sec HomePlug AV powerline kit with a 300Mbps/sec 802.11n Wi-Fi extender built into the second unit.

Since the latter also packs in a pair of 10/100 Ethernet ports, the Trendnet has potential as a basic plug-and-play option for streaming media to a remote bedroom or hooking up a small outside office.

The appeal starts to wane when it comes to setup, however. The powerline part is simple enough: simply plug in one unit near your router and connect the Ethernet port, and the Wi-Fi unit where you're in need of coverage. Unfortunately, you then need to connect to the Wi-Fi network using a WPA2 password, which Trendnet unhelpfully prints on the rear of the unit, below the plug.

To make this worse, the password on our sample was tiny, blurred and almost illegible, requiring a magnifying glass and three attempts before we managed to get

it right. And while there is a WPS button, we couldn't make a connection this way on either of our two test machines.

With this obstacle sidestepped, things proceed more smoothly. By default the Trendnet uses its own SSID, although you can change this to your router's if you want more seamless coverage. We'd also advise you change the password from the get-go so that you can leave the magnifying glass behind.

As with any powerline setup, performance will depend as much on your home's wiring as it will on the units themselves, and you won't get within touching distance of the headline figures. On the positive side, there's no need to find a sweet spot between the router and dead zone as you do with wireless-only extenders.

As for performance, it isn't all that impressive. The Trendnet hit 6.7MB/sec in the mid-range test, and it wasn't any faster over a wired Ethernet connection. In our setup, the powerline speed was clearly the limiting factor. At longer



range, speeds fell to only 3.5MB/sec; acceptable for a 2.4GHz extender, but not exceptional.

Overall, then, while the Trendnet TPL-410APK has value on its side, there's little else to tempt.

KEY SPECS

\$130 • www.trendnet.com

OVERALL



D-Link DAP-1520

CHEAP FOR AN 802.11AC WIRELESS EXTENDER,
BUT PERFORMANCE SIMPLY ISN'T STRONG ENOUGH

D-Link's DAP-1520 seems miraculously good value, sporting dual-band 802.11ac support at a price you'd expect to pay for a single-band 802.11n product.

There are signs it's been stripped back to hit this price point, though: it's the only extender on test without an Ethernet port, and the exterior design is very basic. However, if all you want is a wireless signal in an upstairs room, this might not bother you.

Intriguingly, the DAP-1520 can be set up through either a browser-based control panel or through D-Link's mobile app. The former approach involves logging on to a temporary network and entering a WPA password before you can do anything, so it's not quite as simple a process as it could be.

The app makes setup a little easier, and may also come in handy if you don't have a laptop or PC nearby. By default, the process sets up new SSIDs for the extended 2.4GHz and 5GHz networks,

although it's easy enough to change this later on, should you wish the network names to duplicate the existing ones.

Neither the app nor the extender's onboard LED indicators make it particularly easy to find an optimal position, although a green LED lights up when there's a stable connection to the router. The D-Link failed to recognise our 802.11ac network on the first attempt, but it worked well enough once we'd overcome that hurdle.

At medium range, the DAP-1520 is a mediocre performer, hitting its highest speed – 11.4MB/sec – on the 2.4GHz band rather than the 5GHz 802.11n or 802.11ac network. Only at close range is there any advantage to the 802.11ac support – and your router probably has a stronger signal there anyway.

At longer distances, the D-Link was almost useless: slow on the 2.4GHz band and unable to complete our set of tests in the 5GHz band over either 802.11n or 802.11ac. What we're left with is a money-



saving option for smaller premises, but one that isn't particularly effective in larger spaces.

KEY SPECS

\$120 • www.dlink.com.au

OVERALL



Linksys RE4100W

SPEEDY PERFORMANCE AND AUDIO STREAMING
MAKE THE LINKSYS AN AFFORDABLE CHOICE

Linksys' compact dual-band 802.11n extender is notable for its ability to double as a wireless audio streamer. But where the similarly featured Asus RP-AC52 targets Android devices running specific Asus and third-party apps, the Linksys works as a DLNA-compliant media extender, and even works with the "Play To" button in Windows Media Player. Hook up a pair of speakers and you have a simple wireless music system as well as an extended Wi-Fi signal.

This aside, the RE4100W is short on exciting features. It's a compact and unobtrusive device, but its one and only Ethernet port is a basic 10/100 effort, and its single LED gives precious little help when you're trying to find the optimum position for your new extender. The quick-start guide simply advises you to place the extender halfway between your router and the target dead zone. However, in many situations this isn't the best advice – you'd be better off using trial and error or downloading a third-party Wi-Fi analysis tool for your smartphone.

Setup could be easier, too. The quick-start guide covers linking through to the extender's temporary network and running the browser-based wizard from there, but there's no mention of WPS configuration, which the RE4100W supports.

On the plus side, the browser control panel does include some more sophisticated features, such as site survey, log and diagnostic tools, so it's worth revisiting later. You also get a choice between using your network's existing SSIDs or establishing new ones for the extender.

If you're happy with your existing 802.11n network, then the RE4100W can help you extend it and still achieve decent speeds. In our tests, it reached 13Mbps/sec on the 5GHz spectrum at medium range, and you can still get a half-decent signal and workable transfer speed at longer range as well.

For future-proofing or high-speed networking in closer proximity, the Asus RP-AC52 is a better choice, while our Labs winner, the Netgear Nighthawk AC1900 Extender, will get you better features



and performance, albeit at a higher price. However, if your budget is limited and 802.11ac support isn't a priority, then the RE4100W is a sensible choice.

KEY SPECS

\$105 • www.linksys.com.au

OVERALL



Netgear WN3000RP

A SIMPLE, LOW-COST EXTENDER THAT'S LIMITED BY SLOW SPEEDS AND ITS 2.4GHZ-ONLY SPECIFICATION

It's one of the cheapest extenders around, and it hails from one of the most established networking brands – but unfortunately, the price of Netgear's WN3000RP is reflected in its specs. This is a simple, single-band 802.11n extender with a single 10/100 Ethernet port, two external antennas and not much else. On the plus side, it comes wrapped up in a very small and unobtrusive wall-plug design – it's quite likeable if you're not upset by the sight of aerials.

In theory, setup should be simple, but we were unable to persuade the WN3000RP to connect to our router through the magic of WPS, and had to resort to a clunky browser-based wizard. While not as user-friendly as Linksys' setup process, this worked fine, connecting to the existing network and creating a new SSID. The firmware is still accessible through a browser after setup, providing access to basic configuration, security and status screens.

You receive a bit of help to find the

optimal socket for the WN3000RP, with one red/amber/green indicator covering signal strength between the router and the Netgear, and another covering signal strength between the extender and your device. Running on the 2.4GHz band, the WN3000RP is happier to work in more locations than many extenders; good news when you need your signal to reach further away.

Given the specs, it's no surprise that the WN3000RP is sluggish. At medium range on a 2.4GHz 802.11n connection, it's on the slow side of average, and the 5GHz spectrum is, of course, off-limits.

Longer-range performance is worse: files transfer more slowly than with any of the dual-band extenders bar the D-Link DAP-1520 or BT Dual-Band Wi-Fi Extender 600.

As a result, while the price may be tempting, you'd be best advised to look elsewhere. Not only is single-band 802.11n a poor choice when new dual-band devices might be entering the home or

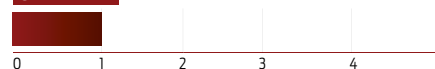


office, but faster dual-band and even 802.11ac extenders can be found for the same price or just a little more.

KEY SPECS

\$99 • www.netgear.com.au

OVERALL



TP-Link RE210

GIGABIT ETHERNET AND STEADY LONG-RANGE PERFORMANCE RESCUE AN OTHERWISE LACKLUSTRE EXTENDER

The TP-Link RE210 has one advantage over rival wall-plug 802.11ac extenders: it offers a Gigabit Ethernet port, where most stick to a basic 10/100 connection. Don't get too excited: the connection between the extender and your 802.11ac router will still be a bottleneck, but at fairly close range this could double as a wireless bridge.

The quick-start guide recommends a WPS setup, which works perfectly well. Using the browser-based wizard gives you more options, however, including the choice of separate SSIDs for the extended 2.4GHz and 5GHz networks. Otherwise, the control panel is functional but spartan, with basic LAN and WLAN configuration pages, update tools and a status page.

As far as finding the optimal location goes, TP-Link could make it a lot easier. The guide advises you to place the extender halfway between your target device and the router, and closer to the router if the signal isn't strong enough. You then need to use a combination

of the WPS and 2.5GHz/5GHz LEDs to assess signal strength. The latter two simply indicate whether you're connected, while the WPS LED lights green, orange or red according to the signal. The Asus and BT extenders make it far easier to find the sweet spot.

The TP-Link is a better performer at distance than it is at closer range. In our medium-range tests, 802.11n 2.4GHz speeds topped out at an average 10.4MB/sec, and dropped in the 5GHz band to 7.9MB/sec. Its 802.11ac speeds are faster than that, at 9MB/sec, but it's still a long way behind the Asus RP-AC52 and ZyXEL WRE6505. However, in our long-range tests it held up better than both, maintaining faster speeds on both the 2.4GHz and 5GHz bands, although still crawling along on an 802.11ac network.

So, if range is more important than bandwidth, the TP-Link is a reasonable choice. However, as with most extenders on test, speeds falter as soon as the extender is moved too far from the router. With its dual antennas, it isn't the most



discreet or attractive device, but it's affordable and reasonably effective at long range.

KEY SPECS

\$78 • www.tp-link.com.au

OVERALL



ZyXEL WRE6505

AN EXCELLENT PERFORMER IN SMALLER HOMES AND OFFICES, BUT LET DOWN BY ITS LONG-RANGE PERFORMANCE

ZyXEL's 802.11 AC750 extender is one of the smallest and lightest on test; it isn't going to win any design awards, but you'll hardly notice that it's there. On the downside, it's also a bit short on exciting features.

The presence of a single 10/100 Ethernet port puts it ahead of the D-Link DAP-1520, as does an access point mode, but you won't find more than simple connectivity here.

The easiest way to get set up is to use WPS to configure the extender, in which case it's automatic, with new SSIDs created for the extended 2.4GHz and 5GHz networks by default. The browser-based configuration feels like a fallback option, although it exposes more configuration and status tools for advanced users.

Positioning is a case of using the colour-coded LEDs to gauge signal strength in each location, with green for good, red for rotten, and amber for somewhere in between. We like the ability to configure the WRE6505 to

prioritise either speed or range. This helps if distance matters, as it does in our long-range tests.

Its 2.4GHz performance isn't up there with the best, either at medium or long range. The ZyXEL struggles to maintain the pace with all but the cheapest extenders. Switch to the 5GHz spectrum, however, and it's a different story. The ZyXEL punches above its weight at medium range, with bandwidth averaging out at 16.8MB/sec on an 802.11n connection and 18.3MB/sec over 802.11ac.

Sadly, the WRE6505 struggled at long range. While it maintained steady 802.11n and 802.11ac connections, unlike some of its rivals, speeds of 0.8MB/sec and 0.9MB/sec are okay for basic email and web browsing but little else.

For smaller premises with 5GHz networks, the ZyXEL WRE6505 is a bit of a bargain, getting you excellent 802.11n and 802.11ac performance at an affordable price. If range is more important to you, however, then this



wouldn't be our pick. The Linksys RE6500 is a better choice if you have more room in your budget.

KEY SPECS

\$71 • www.zyxel.com

OVERALL



View from the Labs

THE BEST WI-FI EXTENDERS CAN IMPROVE THE PERFORMANCE AND RANGE OF YOUR NETWORK, SAYS **STUART ANDREWS** - BUT YOU SHOULD MANAGE YOUR EXPECTATIONS

Are there any specifications as confusing as the numbers printed on the outside of wireless networking products? Promotional messages on boxes and in adverts talk of speeds of 300Mbps/sec, 600Mbps/sec or 1,300Mbps/sec, but try connecting to a router in anything other than optimal laboratory conditions and you'll find real-world bandwidth falls short of the mark.

Throw distance into the mix and those real-world speeds fall further, while with Wi-Fi extenders, the headline speeds grow even sillier. The box still says 300Mbps/sec, 600Mbps/sec or more, while actual throughput inside your home may be as low as 70Mbps/sec.

That's why it's smart to be realistic about your expectations. Buying an extender won't see you backing up files to a NAS drive at 300Mbps/sec if you're working from a back bedroom that hasn't previously been able to get a signal. You still might not be able to get a stable connection in a distant room or the shed at the bottom of your garden.

Whatever manufacturers claim about extending range or improving bandwidth, extenders can't work miracles. In fact, you may find your new 802.11ac router delivers the best performance where you need it on its 802.11n 2.4GHz channel, while the

"Whatever manufacturers claim about extending range or improving bandwidth, extenders can't work miracles"

5GHz AC750 channel provides the most advantage in areas where your router already delivers a high-quality connection.

What the best extenders can do is further the reach of your network. Netgear's Nighthawk AC1900 Extender provided us with solid, high-speed connectivity in a room that our AC1900 router could barely reach. The same goes for the Linksys RE6500, Asus RP-AC52

and ZyXEL WRE6505.

Sure, 130Mbps/sec (15.5MB/sec) isn't 1,300Mbps/sec, but it's fast enough for most applications. Many of our uses require more modest amounts of bandwidth, and often the biggest bottleneck is the broadband connection. What's more, 130Mbps/sec is much better than you'll see from a range of 500Mbps/sec powerline kits that are hamstrung by a 100Mbps/sec Ethernet port.

That's not to denigrate powerline adapters, though, since they also have their place. We originally planned to test long-range bandwidth in a home office located 20m from the router. Unfortunately, only one pure wireless extender could get a signal, and even that one – our Labs winner – couldn't manage anything faster than a crawl.

This office has been served by powerline networks for five years, and will continue to be served by them for the near future. After all, a slow connection might be disappointing, but it's better than none at all.

Results & how we test

All the extenders on review in this Labs were tested in a carefully controlled domestic environment, enabling us to compare the products objectively.

We first connected each extender to a network powered by a Linksys EA6900 AC1900 router. To this network, we then connected two desktop PCs, one plugged via Gigabit Ethernet into the router, and one connecting to the extender via a triple-antenna 802.11ac AC1900 PCI Express card.

Both PCs were fitted with SSDs to ensure no bottlenecks on that count. With the router and PC 1 downstairs, we set up PC 2 12m away upstairs, where wireless signal strength is

normally weak.

We then connected each extender in turn, and transferred 500MB video files from one system to another, measuring real-world transfer speeds over 2.4GHz, 5GHz 802.11n and 5GHz 802.11ac connections.

We then repeated the test at longer range in a garden building 20m from the router, using a laptop fitted with an SSD and a dual-antenna USB AC1200 adapter, giving a set of mid- and long-range test results. We've presented the results in the table below, colour-coded to help you spot the fastest and slowest products. ●



	MID RANGE (MB/SEC)			LONG RANGE (MB/SEC)		
	2.4GHz	5GHz (802.11n)	5GHz (802.11ac)	2.4GHz	5GHz (802.11n)	5GHz (802.11ac)
Netgear Nighthawk AC1900 Extender	12.8	17.9	20.1	7	5.7	5.9
Linksys RE6500	13.5	13.4	12.8	4.4	6	5.8
ZyXEL WRE6505	8.8	16.8	18.3	3.8	0.8	0.9
Asus RP-AC52	10	11.9	14.5	3.6	3.3	3.4
TP-Link RE210	10.4	7.9	9	4.5	3.4	1.6
D-Link DAP-1520	11.4	8.2	9.2	2.3	WNC*	WNC*
Linksys RE4100W	11.2	13	N/A	3.5	3.3	N/A
BT Dual-Band Wi-Fi Extender 600	10.8	12.8	N/A	1.5	WNC*	N/A
Netgear WN3000RP	10.8	N/A	N/A	2.7	N/A	N/A
Trendnet TPL-410APK	6.7	N/A	N/A	3.5	N/A	N/A

* WNC – would not connect

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Fallout 4

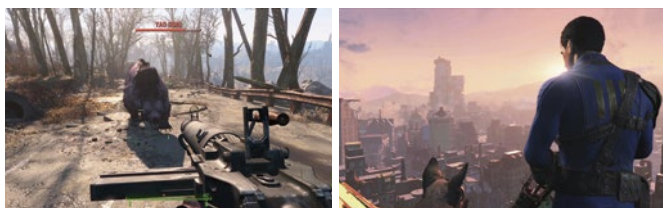
Fallout 4's announcement couldn't be more timely, or succinct. Among the many appeals, Bethesda announced a whole raft of customisation options, mod support for consoles, and, as a first for the series, a voiced playable character.

Other innovations include changing the V.A.T.S. system, so that it follows a more bullet-time approach, rather than freezing time and acting as an 'auto-win' button. Previews also show power armour that players climb inside, a more dynamic pip-boy UI which also includes retro-style mini-games, and a dialogue system that allows players to leave a conversation, or shoot the NPC they're talking to.

Building on the news and anticipation, Bethesda has released Fallout Shelter, a free mobile app that's more asset than gimmick, offering hours of gameplay that doesn't rely on typical skinner-box madness to keep players entranced.

www.fallout4.com

Developer: Bethesda Game Studios Publisher: Bethesda Softworks Release: Q3 2015



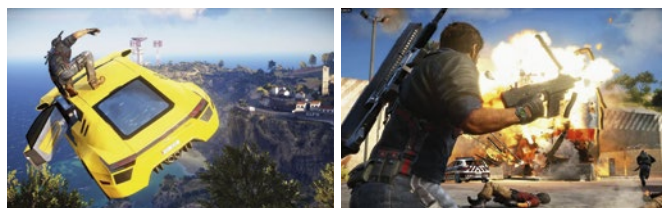
Just Cause 3

Knowing that the wafer-thin plotlines of the last game were less than pointless, Avalanche decided to follow in the same vein, bringing Rico to his hometown to liberate it from an evil dictator and restore peace by any means necessary. In Rico Rodriguez' case, this involves thousands of explosions. This makes about as much sense as anything that comes with a Scarface-sound-alike armed with unlimited C4 and a gravity-defying, momentum cancelling, grappling hook. That said, deep plotlines don't come hand in hand, when the world resembles the best action movies of the last thirty odd years.

Set in the Mediterranean-ish isle of Medici, Just Cause 3 takes destruction further than before, removing many of the limits that hampered the last game, making this less of an open world action adventure, and more of a sandbox filled with wonderful toys to play with and destroy.

justcause.com/en-au

Developer: Avalanche Studios Publisher: Square Enix Release: 2015



Ion

From DayZ' creator, Dean Hall, comes Ion. The game is an MMO which takes players through human exploration of outer space, a space-simulator MMO that allows players to join and play a part in man's exploration of the universe. Using an isometric camera, the game is realised in fully 3D environments, which will feature a persistent narrative that sees players manage the insides of space stations, as much as expand their reach through the stars.

Hall said the game allows for simulation of every in-game entity, including their organs; a bug he found was that when players clicked on an npc, all of their organs would fall out. The game's environments simulate air pressure, climate control, power grids, and other facets of space-station upkeep which players must control to keep their crews alive.

Developer: Dean Hall Publisher: Microsoft Release: TBA (early access)



Space Hulk: Deathwing

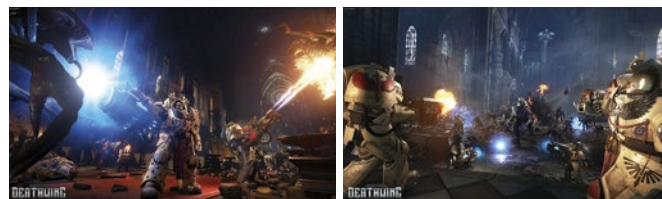
Deathwing brings to life the traditional table-top Rogue Trader games of yesteryear in glorious 3D. Featuring Space Marine Terminators and Tyranid Genestealers, the game will play from the first-person perspective.

Moving through a Space Hulk means there's more than just linear paths to the campaign; confining tunnels and massive holds contain multiple sprawling passages through the ship, trailing to secondary objectives which add to the game's length.

The game stars the player as a Space Marine librarian in charge of a squad of Space Marine Terminators; pitted against Tyranid Genestealers and hybrids, who use a combination of lightning rush attacks, and ranged weaponry. Damage is location-based, meaning that the Genestealers will try to attack players from behind, upping the tension as they appear.

www.spacehulk-deathwing.com

Developers: Streum on Studio, Cyanide Publisher: Focus Home Interactive Release: 2015



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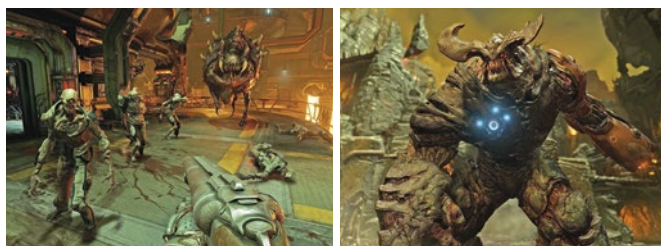
Doom

The reboot for this classic series could not have come at a better time; nestled amongst Bethesda's winning conference at E3, Doom takes the same near-non-existent story from the first games (demons on Mars!), the same enemies, and refurbishes them with modern graphics and intense gameplay.

Doom seeks to emulate the same fast-paced shooting the classic introduced, while introducing crunchy melee kills, vaulting and mantling, and giving enemies the opportunity to kill the player with their own brand of brutality. Players can expect a game that doesn't take itself as seriously as other titles; as Pete Hines said, the game isn't a survival horror, but rather a "visceral action game". Players can rip off an enemy's arm and carry it to unlock doors, as well as use the classic BFG 9000.

bethsoft.com/en-us/games/doom

Developer: id Software Publisher: Bethesda Release: 2016



Dishonored 2

After the success of Dishonored, the game seemed to quietly sink under the radar following the usual powerhouse releases, only to be kept alive by dedicated fans. Now, with Dishonored 2's showing at E3, those fans can now play as a grown-up Emily Kaldwin, and an "older and wiser" Corvo Attano, in the coastal city of Karnaca.

What little is known is this: time-stopping powers return, alongside an ability called 'far reach' which works like a grappling hook, and may replace the previous game's teleportation. Little about the plot is known, with the trailer stating that Emily has lost her empire, alongside showing swarms of insects that seem to take the place of the previous game's plague rats, robot enemies, along with more powers and gadgets to fill the game.

www.dishonored.com

Developer: Arkane Studios Publisher: Bethesda Softworks Release: 2016



Deus Ex: Mankind Divided

Mankind Divided brings back Adam Jensen in a new adventure that explores what it's like to be transhuman in a world that is in turmoil. Due to the events of the previous game, cyborgs are met with mistrust and hatred, marginalised instead of being celebrated as they once were. The game promises to explore issues of this 'cyber-apartheid', as the developers termed it, while the overarching plot of shadowy corporations seeking world domination unfolds. Though with a less yellowed palate than the last game, Mankind Divided still leans closer to its predecessor than it does to the first Deus Ex.

Players will find Jensen's arsenal has been augmented; his knuckles now fire electro-shock darts, his arms contain PEPS guns, and his arm-blades can be fired at distant enemies, alongside his ability to cover himself with nanomachines to form a jagged looking shield, and the option to change weapon-customisations on the fly – like Crysis. The game promises the same options of pacifist-runs and frantic gun fire.

www.deusex.com

Developer: Eidos Montreal Publisher: Square Enix Release: 2016



MGSV: The Phantom Pain

Reminding us all that Hideo Kojima really knows how to cut together a good trailer, the hype for the fifth numbered instalment in the Metal Gear Solid series has been building since that first, strange trailer, simply titled 'The Phantom Pain'.

Going heavier on the symbolism with each new release, the game will chronicle long-time protagonist Big Boss' descent into villainy. While the game's gameplay takes many cues Ground Zeroes, it has several features that set it apart from the former title, including horse riding, a waiting time-shift function, and the D-Walker; a customisable robot that can be driven, and specked for stealth or combat.

Its expansive open world promises a lengthier campaign, which takes Snake through Afghanistan while he looks for whatever 'walking death machine' is on the cusp of plaguing the world this time. This next entry has also hinted at providing more lore behind the backstory of Big Boss' synthetic progeny, while providing absurd humour.

www.konami.com/mgsv

Developer: Kojima Productions Publisher: Konami Release: 1, 11, 2015



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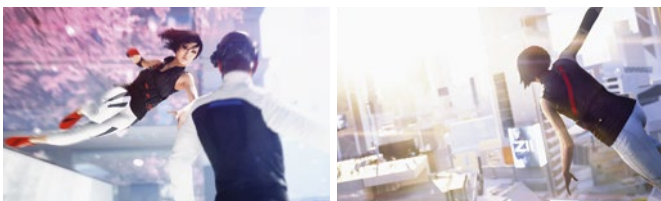
Mirror's Edge: Catalyst

Eight years after the release of Mirror's Edge, players will once again have the chance to step into the shoes of parkour runner extraordinaire, Faith Connors. Parkour is fairly ubiquitous in games, but what makes the Mirror's Edge games stand out from the pack is the fact that they are played from a first person perspective, so every jump, slide, swing, wall-run and roll becomes an immersive, vertiginous thrill.

A prequel to the original game, Mirror's Edge: Catalyst delves into Faith's back story and expands the city, eschewing the linear levels of the first game for a semi-open world rife with the potential for exploration. The combat mechanics have been completely overhauled – Faith will no longer be capable of picking up guns so must rely on two different types of melee attacks to defeat enemies – momentum attacks that allow her to disable an enemy whilst maintaining her momentum, and transference attacks that transfer her momentum to an enemy, knocking them through windows, off roofs or into other enemies.

www.mirrorsedge.com

Developer: EA DICE Publisher: EA Release: Feb, 2016



Star Wars Battlefront

The third major release in the Star Wars: Battlefront series is being developed by Digital Illusions CE (DICE), and this is big news for the franchise. Best known for their acclaimed Battlefield series, DICE is renowned for making multiplayer military shooters and from the hands on impressions so far this expertise shines through in Battlefront. Featuring both cooperative missions (playable solo, with bots or with other players) as well as competitive multiplayer.

At launch the game will feature 12 maps set across the Star Wars universe, including familiar areas such as Tatooine, Endor and Hoth, each large enough not only to support 20 players a side but familiar Star Wars vehicles as well. As either a Rebel Alliance soldier or an Imperial Stormtrooper, players will have access to a number of iconic land and air vehicles from the Star Wars universe, including TIE Fighters, X-Wings, AT-AT walkers and Speeder Bikes. Each map is locked to the planet so there is no avenue for space battles, but that shouldn't detract.

www.dice.se/games/star-wars-battlefront/

Developer: EA DICE Publisher: EA Release: Nov, 2015



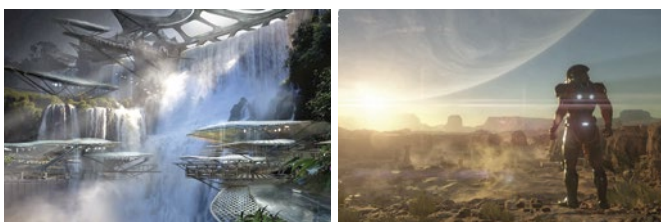
Mass Effect: Andromeda

There aren't a lot of details available as to the story of Mass Effect: Andromeda as yet, but even so it's still one of the most exciting games on the horizon. Set many, many years after the events of the original Mass Effect, Commander Shepard lead roleplaying trilogy, Andromeda will tell a brand new story and is set in an entirely new galaxy for players to explore. To facilitate this, players will have access to a redesigned M35 Mako, the all-terrain planetary exploration vehicle used throughout the original trilogy.

Players will be able to create their own human character or either sex to lead a new crew. Interestingly, in the information revealed so far there has been no mention of the character's title or position, but the character is designated N7 – that's Mass Effect speak for a Special Forces operative trained to the highest level of proficiency. The announcement trailer also shows that mankind has rediscovered faster than light travel after the apocalyptic end of Mass Effect 3. We wouldn't be surprised if the secret behind this rediscovery is a main factor of the overall plot.

www.bioware.com

Mass Effect: Andromeda Developer: BioWare Publisher: EA Release: Q4, 2016



For Honor

Straddling the line between a first person action game and a MOBA (Multiplayer Online Battle Arena), For Honor features three factions, The Chosen, The Warborn and The Legions – knights, Samurai and Vikings respectively – battling it out using an innovative melee combat system known as 'Art of Battle'. When players confront each other they enter a duelling mode that enables them to change stances and the directionality of attacks or blocks. By keeping an eye on the opponents movements and position players can pre-empt attacks or defences.

In competitive multiplayer, For Honor only supports up to eight players – four a side – but each team is bolstered by a number of AI soldiers that will help achieve objectives or attack enemy players. These AI characters are easy to kill for players and can be farmed for experience to gain levels, unlocks and perks. By achieving objectives and killing enemy players, teams gain points, and once a certain point threshold is met the opposing team can no longer respawn. Matches end when all the players on one team are permanently killed.

forhonor.ubisoft.com

Developer: Ubisoft Montreal Publisher: Ubisoft Release: TBA



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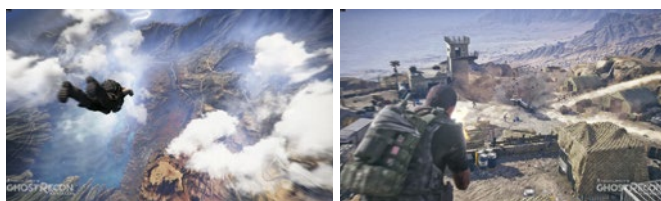
Ghost Recon: Wildlands

The Ghost Recon series of tactical stealth shooters have always been huge games, but the newly announced Wildlands is by far the biggest of all. Set in Bolivia, the largest supplier of illicit drugs in the world (according to the game), players take the role of US Special Forces "Ghost" operatives tasked with disrupting the operations of the Santa Blanca drug cartel and eliminating their chain of command.

The open world allows players to approach missions in multiple ways, with many variables effecting how firefights may end. The game will feature a full day/night cycle and AI characters each have their own rhythms that fit in with the time of day, and the level of available natural light also effects the effectiveness of stealth, cover and how easily enemies can be spotted. Although the game has a full single player campaign, the E3 demo demonstrated that co-operative multiplayer is really the name of the game, with up to four players being able to combine forces to take on the cartel.

ghost-recon.ubi.com

Developer: Ubisoft Paris Publisher: Ubisoft Release: TBA



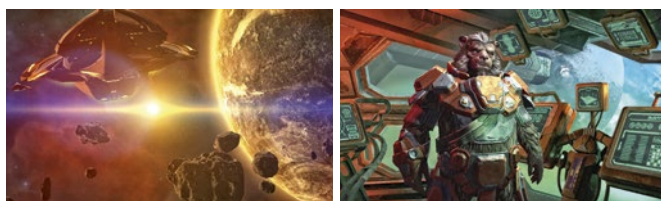
Master of Orion

The 1993 classic, Master of Orion essentially created the 4X (eXplore, eXpand, eXploit, eXterminate) genre, so it came as a bit of a surprise when the company behind the free-to-play success story, World of Tanks bought the rights to the game in 2012. There was a fear that the name might be appended to a new free-to-play space combat game but those fears have proven unfounded – the new game will be a straight retail product faithful to the spirit of the original whilst incorporating elements of Masters of Orion 1 and 2.

Argentinian developer NGD Studios is handling development of the new Master of Orion and the team includes a number of the original Master of Orion developers, including the art director and music composer. There is no set release date or window for Master of Orion as yet, but according to Wargaming CEO Victor Kislyi this is because Master of Orion isn't a tentpole franchise, so the developers can take as long as needed to make the game perfect.

www.wargaming.com

Developer: Wargaming.com Publisher: Wargaming.com Release: 2016



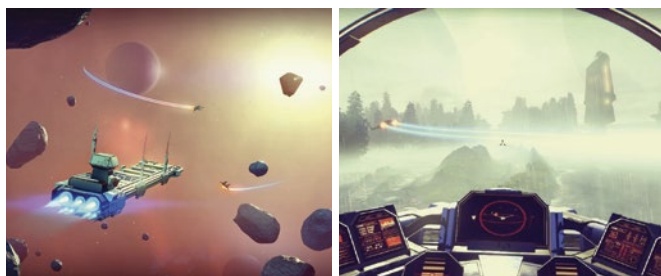
No Man's Sky

One of the most amazingly ambitious independent games we've ever seen, No Man's Sky is an adventure game in which the player is given a ship and a procedurally generated universe to explore. How big is this universe? Unbelievably big. The final release of the game will use a 64-bit seeding key for the generation of stars and planets using a massive database of variables. In real world terms, the game could theoretically contain, according to the developers, 18 quintillion planets.

Players are initially given a vast, seemingly uncharted universe to explore in which any planet visited, named and explored can be uploaded to a universal database via beacons. There is an actual goal to the game aside from the simple joy of exploration. It's a race to the centre of the universe to discover what lays there, but to achieve this goal, players have to find resources on planets, trade information and technology and upgrade their ship and fuel supply to achieve the mammoth journey.

www.no-mans-sky.com

Developer: Hello Games Publisher: Hello Games Release: TBA



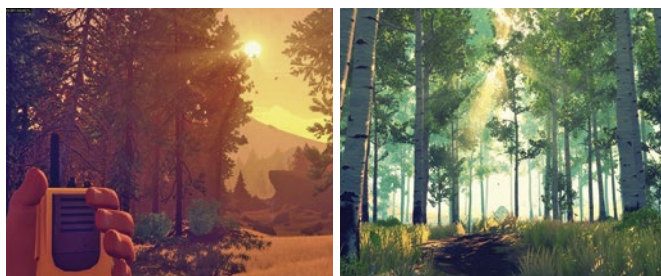
Firewatch

In this first-person adventure game set in the wilderness or Wyoming circa 1989 in the aftermath of the 1988 Yellowstone fires, players take the role of a solitary fire lookout named Henry. Whilst out exploring his surroundings to discover why his radio is offline, Henry's lookout tower is ransacked. Does this have something to do with the hikers who have gone missing in the area or is the problem something more personal?

We have a feeling that Henry's reason for taking up his position will play a large role in the mystery. With the tower radio down, Henry's only lifeline to the outside world is his walkie-talkie and his only point of contact is his supervisor, Delia. Delia can be contacted at any time and multiple dialogue choices will be available for each interaction, but how players choose to respond to speak to Delia will affect the tone of Henry's relationship with his only point of contact with the world he left behind when he took his lonely position.

www.firewatchgame.com

Developer: Campo Santo Publisher: Panic Release: 2015



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The A-List

ONLY THE BEST OF THE BEST MAKE IT TO PC & TECH AUTHORITY'S A-LIST

The A-List stays solid this issue with no changes. But do please turn the page, for it's all happening in the exciting world of PC components!



PC DESKTOP

ALL-IN-ONE
Apple iMac 27in

★★★★★

PRICE \$2,199

SUPPLIER www.apple.com/au

If you can afford it, the 27in iMac is the finest piece of all-in-one engineering on the market. A truly powerful beast with performance to match its looks..

SPECIFICATIONS 3.2GHz quad-core Intel Core i5; 8GB DDR3 RAM; 1TB Western Digital Caviar Black HDD; NVIDIA GeForce GT 750M 1GB; 27in 2560 x 1440 LCD.



PERIPHERALS

WIRELESS ROUTER Netgear
Nighthawk X6 AC3200

★★★★★

SUPPLIER www.netgear.com.au

Designed to keep pace with high-bandwidth content consumption, it is the router King.

SPECIFICATIONS 1GHz dual core processor with 3 offload processors, 6 High performance antennas, one 2.4GHz band and two 5GHz Wi-Fi bands

DESKTOP STORAGE CalDigit T3
with Thunderbolt 2

★★★★★

SUPPLIER www.amazon.com

The T3 is an expensive RAID device, but when you factor in the drives and the capacity included, it's good value.

SPECIFICATIONS 6/9/12/15TB external hard disk with RAID; Thunderbolt and Thunderbolt 2, 135 x 241 x 116mm 4.5kg.



NAS Synology
Diskstation DS415play

★★★★★

SUPPLIER www.synology.com

For most home users, the DS415play is very impressive. It's an all in one box that can literally do it all.

SPECIFICATIONS 24x SATA 3 2.5"/3.5" drive bays - Intel Atom Dual Core 1.6GHz CPU - 1GB DDR3 RAM - 2x USB 3.0 & 3x USB 2.0 - 1x Gigabit Ethernet

ALL-IN-ONE PRINTER
Canon Pixma IP 8760

★★★★★

SUPPLIER www.canon.com.au

This Canon can do it all, and at a reasonable price.

SPECIFICATIONS 9600 x 2400dpi print; 2400 x 4800ppi scan; USB 2; 802.11n WLAN; 150-sheet tray

LASER PRINTER Dell B1160w

★★★★★

SUPPLIER www.dell.com.au

The best all-rounder in our printer group test, with excellent text printing and decent costs.

SPECIFICATIONS 1800 x 600dpi resolution; USB 2; Wi-Fi; 150-sheet input trays; 331 x 215 x 178

LAPTOPS



VALUE Asus TF103C

★★★★★

PRICE \$429

SUPPLIER www.asus.com.au

While ostensibly a tablet with a removable keyboard, it also fits tidily into the value portable category thanks to its immense usability and remarkably low price.

SPECIFICATIONS Quad-core 1.86GHz Intel Atom Z3745 • 1GB RAM • 8GB/16GB eMMC storage • 10.1in 1,280 x 800 IPS display • dual-band 802.11n Wi-Fi



PERFORMANCE Aorus X7

★★★★★

PRICE \$2,999

SUPPLIER www.aorus.com

Super-sleek, light, outrageously powerful and with a spec-list that outclasses many high end desktop systems.

SPECIFICATIONS Q4-3.4GHz i7-4700HQ • 4GB/8GB DDR3L 1600, 4 slots (Max 32GB) • 17.3" Full HD 1920x1080 • NVIDIA® GTX 765M SLI GDDR5 4GB • mSATA 128GB/256GB, 2slot 2.5" HDD 500GB/750GB/1TB 5400rpm



PROFESSIONAL Apple Macbook Pro Retina

★★★★★

PRICE \$2,499

SUPPLIER www.apple.com/au

We've selected the 2.9GHz i5 model with 8GB of RAM and a 512GB SSD. Doubling the RAM adds another \$280. Some may find, though, the 13 in screen size to be limiting.

SPECIFICATIONS 2.9GHz Intel Core i5; 8GB RAM; 512GB SSD; 13in 2560 x 1600 LCD; 2 x USB 3; 2 x Thunderbolt 2; dual-band 802.11ac abgn Wi-Fi



ULTRA PORTABLE Microsoft Surface Pro 3

★★★★★

PRICE \$1,549

SUPPLIER www.microsoft.com.au

Attach the Type Cover 2 and it's as good, if not better, than any 'proper' ultra portable laptop. It took three versions, but Microsoft has nailed this format. At least an i5 is recommended.

SPECIFICATIONS 1.9GHz Intel Core i5-4300U; 12in touchscreen (2160 x 1440); 8GB RAM; 256GB SSD; 802.11ac/abgn; Bluetooth 4

HANDHELDS

SMARTPHONE Samsung Galaxy S6

★★★★★

PRICE \$999

SUPPLIER www.sony.com.au

If only the best will do, look no further: the Samsung Galaxy S6 is the best smartphone on the market.

SPECIFICATIONS 2.5GHz Qualcomm Snapdragon Octa-core 2.1GHz/1.5GHz ARM Exynos 7420 SoC • ARM Mali-T760 GPU • 3GB RAM • 32/64/128GB storage • 5.1in 4K video • 2,550mAh battery • 1yr RTB warranty • 71 x 6.8 x 143mm (WDH) 1138g



TABLET Apple iPad Air 2

★★★★★

PRICE \$539

SUPPLIER

www.apple.com/au

The iPad Air 2 is definitively the best tablet on the market right now, and rightfully replaces its predecessor on our A-List.

SPECIFICATIONS 1.5GHz Apple A8X SoC • 2GB RAM • 16/64/128GB storage • 9.7in 1,536 x 2,048 IPS display • 7,340mAh battery



EBOOK READER Kindle

★★★★★

PRICE \$109

SUPPLIER

www.amazon.com

The new model is quicker, slimmer, lighter and cheaper than before. If all you want to do is read books, its simple design and performance are perfect.

SPECIFICATIONS 6in e-Ink screen, 170g weight, 114 x 87 x 166 mm, 2GB memory, 10-day battery life • WEB ID 279534



SOFTWARE

SECURITY Norton Security 2015

★★★★★

SUPPLIER www.norton.com/security

Great malware protection and equally good legitimate software recognition

BACK UP Acronis True Image 2015

★★★★★

SUPPLIER www.acronis.com.au

The 2015 version adds full-system backup and dual backup and unlimited cloud storage.

OFFICE SUITE Microsoft Office 365 Home Premium

★★★★★

SUPPLIER www.microsoft.com.au

The easiest to use Office to date.

WEB DEV Adobe Dreamweaver CS6

★★★★★

SUPPLIER www.adobe.com.au

This edition makes PHP and CMS its core focus.

AUDIO Cubase 7.5

★★★★★

SUPPLIER www.steinberg.net

The addition of better filters solidifies this program's continued place on the A-List.

VIDEO Sony Vegas Movie Studio HD Platinum 11

★★★★★

SUPPLIER www.sony.com.au

May not have the bells and whistles of other consumer editing packages, but its tools are efficient.

PHOTO Adobe Photoshop Lightroom 6

★★★★★

SUPPLIER www.adobe.com.au

Lightroom 6 doesn't add up to a revolutionary update, but it improves on what was already an exceptional piece of software.

The Kitlog

DREAM BUILDS WITH REAL GEAR

With component prices having crept up over the last few months, it's time to reassess parts of our build that, really, are a bit over the top. The target this month is the Game Box's motherboard and CPU. Frankly, the Z97 Asus Ranger is overkill, and with a saving of \$100 achieved by switching to an almost as capable H97-based board, it's well worth doing.

Our choice is the excellent MSI H97 Gaming 3. At around \$150 it includes game-specific features that many cheaper H97 boards don't, with the Killer LAN controller at the top of our list. Onboard audio is also top notch, and we do like the twin headphone amps onboard.

A spinoff effect of this change is that our previous CPU needs another look. We'd been running with the Intel i5 4690K for several months, but need to switch that down a level as the K-series is wasted on an H97 board. Our choice is the i5 4690, which matches the K version's stock speed of 3.5GHz, and saves us \$25, which was reinvested in a nice steak lunch.

The Game Box farewells the long-standing TT Esports Chronos headphones, and we welcome in its place the outstanding HyperX Cloud II (review on page 58). For the price (\$149) there is nothing better.

Our review of the Gigabyte GTX 980 Ti (page 51) makes it clear that the Titan X's short reign is over. When running this card in OC mode it toasts the Titan X, and is almost \$500 cheaper.




Our review of the Philips BDM4065UC (page 54) leaves no doubt that it deserves to be our Perfect PC screen of choice. The 40inch 4k monster is exceptional value.

Lastly, in this month of change, we see the Intel 750 SSD replace the Samsung 850 Pro. If you're going to really build the Perfect PC, then SATA has had its day at the top of the SSD pile. See our review on page 45 for the full story on this incredible SSD.

THE GAME BOX

CPU	MOTHERBOARD	MEMORY	VIDEOCARD	 <p>NEW INTEL CORE I5 4690 PRICE \$295 A stock speed of 3.5GHz and turbo at 3.7GHz is all the gaming grunt you need right now.</p>
				 <p>NEW MSI H97 GAMING 3 PRICE \$159 Everything you need on a gaming board at a very nice price. The H97 chipset will limit overlocking, but the stock CPU has the beans for any game.</p>
				 <p>KINGSTON HYPERX BEAST 16GB PRICE \$219 Our roundup award winner, it's well-priced, fast and overlocks very well.</p>
				 <p>NVIDIA GTX 970 PRICE \$500 Quiet, sips power, but when the performance is needed this blazer eats up the frames.</p>

THE PERFECT PC

CPU	MOTHERBOARD	MEMORY	VIDEOCARD	 <p>INTEL CORE I7 5820K PRICE \$535 Six cores, plus an additional six Hyper-Threading cores.</p>
				 <p>GIGABYTE X99 SOC CHAMPION PRICE \$420 Supreme engineering and component quality for rock solid reliability.</p>
				 <p>CORSAIR DOMINATOR PLATINUM CMD32GX3M4A2133C9 32GB PRICE \$640 These memory chips are hand selected and tested, and 32GB of fast RAM will keep things smooth and fast in intensive tasks.</p>
				 <p>NEW GIGABYTE GV-N98TG1 GAMING 6GD PRICE \$1099 Faster than a Titan X when in OC mode and several hundred dollars cheaper.</p>

TOTAL: \$2955 RIG ONLY: \$2078

COOLER



COOLERMASTER NEPTON 140XL

PRICE \$120

Easy to install AIO CPU cooling, relative quiet and performance to rival twin-radiator units.

CASE



BITFENIX RONIN

PRICE \$99

BitFenix continues to deliver great budget cases that look terrific and are easy to build in.

SYSTEMDRIVES

SAMSUNG 850 PRO 512GB

PRICE \$449

Samsung's newest SSD offers greatly improved durability. Supplement it with a hard drive of your choice if needed.



KEYBOARD

CORSAIR K70

PRICE \$170

The glorious perfection of mechanical keys with well thought-out gamer design.



DISPLAY



LG IPS277L

PRICE \$499

27 inches of IPS glory. The resolution isn't perfect, but the price is. The thin bezel makes this a very attractive screen.

MOUSE



RAPOO V900

PRICE \$69

Accurate, good lift-off performance and decent ergonomics at a fairly amazing price.

AUDIO

HYPERX CLOUD II

PRICE \$149

The HyperX Cloud II provide excellent sound quality and not just for the price range.



NEW

SOUND BLASTER X-FI XTREME

PRICE \$80

The best positional game audio at this price and good music quality.

POWER SUPPLY

COOLER MASTER G750M

PRICE \$125

Outstanding value for money, it's powerful enough for even performance PCs packing twin GPUs.



TOTAL: \$6017 RIG ONLY: \$4765

COOLER



CORSAIR H100i GTX WATER COOLER

PRICE \$179

Excellent cooling that is easy to install with advanced monitoring.

CASE



CORSAIR GRAPHITE 380T

PRICE \$259

Lovely form and brilliant function along with the highest quality.

SYSTEMDRIVES

INTEL 730

PRICE \$1499

This is easily the fastest consumer drive we have tested, and by a large margin.



NEW

SEAGATE BARRACUDA 2TB

PRICE \$100

Supplement the PRO with cheap HDD storage.

KEYBOARD

CORSAIR VENGEANCE K95

PRICE \$189

The perfect keyboard. Lovely Cherry Red mechanical switches, a slick and attractive aluminium body and customisable backlighting make this The One.



DISPLAY



NEW

PHILIPS BDM4065UC 4K 40"

PRICE \$1033

It's huge, remarkable value and having one in front of you is PC paradise.

MOUSE



CM STORM REAPER

PRICE \$85

Very solid and feels fantastic under the hand with sweet on-screen movement.

AUDIO

CREATIVE SOUND BLASTER ZXR

PRICE \$289

Superb music and general audio, with the versatility of a comprehensive set of connectivity options.



POWER SUPPLY

CORSAIR HX1000i

PRICE \$299

Corsair's mighty HX1000i pumps out extremely reliable power, even when under full loads.





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- 4 nights twin share accommodation at Rendezvous Hotel Singapore
- 2 x passes to select Grand Prix Season Singapore experiences
- Airport transfers in Singapore

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www.yoursingapore.com

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Please note that the winner of the competition will be required to travel on Friday 18 September 2015



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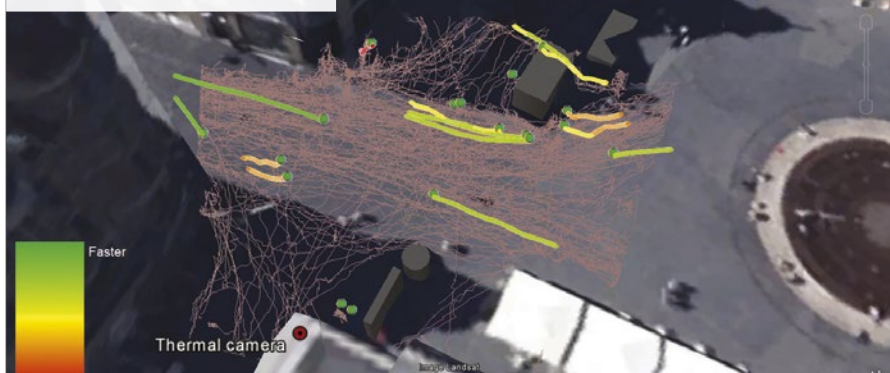
Price offer available to Australian and NZ residents. Expires 9/8/15. New Zealand: 12 issues for A\$89.95. Overseas airmail: 12 issues A\$127. Savings based on total cover price; includes GST. Subscription will commence with next available issue. Please allow 6-8 weeks for delivery of your first magazine. Competition open to new, renewing or extending Australian and NZ residents, subscribing to PC & Tech Authority for a minimum 1 year. Enter by subscribing between 00:01 AEST 13/7/15 and 23:59 AEST 9/8/15 - for a full list of participating titles visit www.mymagazines.com.au. This is a game of skill. You will be eligible by answering the question "In 25 words or less, which F1 team would you like to race for, and why?". 1 subscriber will win a trip for 2 to Singapore, to watch the 2015 Formula 1 Singapore Airlines Singapore Grand Prix, prize valued at \$10,000.00. Total prize pool is \$10,000.00. The winner and their travelling companion will be required to depart for Singapore at the same time on 18/9/15 from their closest city (flights available ex-Sydney, Brisbane, Melbourne, Perth or Adelaide). If the winner elects to partake in any or all portions of the prize with no travel companion, the prize will be awarded to winner and any remainder of the prize will be forfeited and shall not be subject to further or alternative compensation. The winner and their travelling companion must each hold a valid passport with at least 6 months validity in order to redeem the prize. Obtaining all travel documents such as passports, visas etc. is the responsibility of the winner and their travelling companion. In participating in the prize, the winners agree to participate and co-operate as required in all editorial activities relating to the competition. The winner shall take the prize as offered. Prize is non-transferable, non-refundable and cannot be redeemed for cash, credit or foreign exchange or used in conjunction with other offers, discount or promotion. Entries will be judged by the editorial teams on 25/8/15. The most creative answer will win. The judge's decision is final and no correspondence will be entered into. The Promoter is nextmedia Pty Ltd, 207 Pacific Highway, St Leonards, NSW 2065. ABN 84 128 805 970. For full terms and conditions visit www.mymagazines.com.au/hzsub/pdf/SINGAPORE_TERMS.pdf.

THE BACK SECTION

Real world experience, the newest of the new in tech and some strong opinion

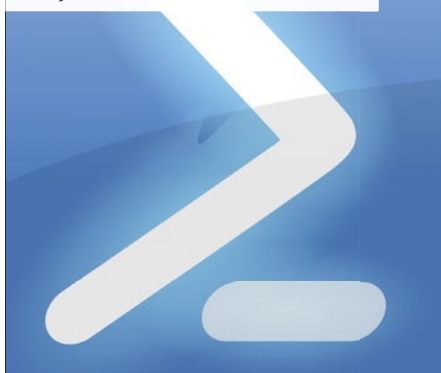
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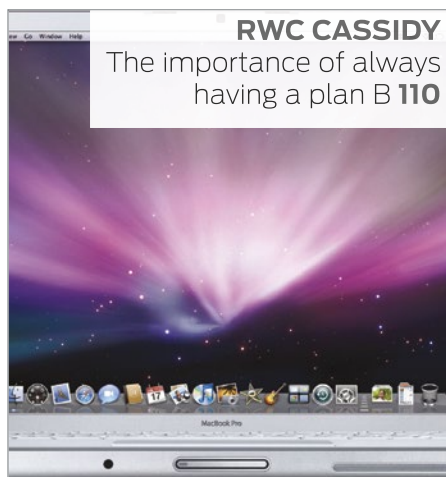
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Chinese OnePlus One a "flagship killer" **103**



BRING YOUR PROJECT TO LIFE ON KICKSTARTER

Got an idea for a technology project or product? Professional fundraiser **Lise Smith** reveals how to find funding on Kickstarter to make it a reality



Kickstarter is the perfect platform for getting your app, service or other technology project off the ground. Recently, products such as the Pebble Time smartwatch have attracted US\$20.3 million from more than 78,000 backers keen to get the device off the starting blocks, while the Exploding Kittens card game met its US\$10,000 funding goal in only eight minutes. More than US\$1.6 billion have been pledged through the site since launch, with a current funding success rate for new projects of around 40%. So how can you ensure that your project ends up in that 40% category with a full funding thermometer?

The first thing to understand is Kickstarter's "all or nothing" funding model. Put simply, this means that if you raise your target sum, you receive the money – but if you don't, you get nothing. This model is intended to motivate backers by giving funding targets some urgency; if you'd rather keep hold of any money you raise, check out alternative platforms such as Indiegogo (indiegogo.com) or GoFundMe (gofundme.com).

It's also important to be aware that you won't receive 100% of the money pledged. Kickstarter charges a commission of 5% on successfully funded projects, and payment processing costs a further 3–5%. This means that for every \$1,000 your project requires, you'll need to raise around \$1,100 in total. To see how you can do that, let's break down a Kickstarter campaign step by step.

SETTING UP AN ACCOUNT

The first thing to do is ensure that your project meets Kickstarter's criteria. That means it must have one or more definable objects – clear goals with a product, event or experience as the end result – and a defined timeline for achieving them. Kickstarter can't be used for general business or charitable fundraising; other platforms such as GoFundMe can help if this is your aim. Check the full list of exclusions at tinyurl.com/op4ryoh.

✓ Many startups have raised funding for projects on Kickstarter

You should also consider the scale of your project. If it's very long or very complex, consider dividing it into a number of separately funded stages (so that each phase of your campaign has its own funding target and a delivery goal). This can build confidence in your backers as you successfully meet each stage of the project, as well as splitting your funding targets into manageable chunks.

Once you're confident about the suitability and scope of your project, it's time to get a feel for what a successful campaign looks like. Kicktraq (kicktraq.com) analyses current and past Kickstarter projects in depth; browse the "Hot List" as you plan your project to see what works and what doesn't. Finally, it's time to set up an account on Kickstarter: to do this you'll be asked for basic information about the project, including your project category and funding target.

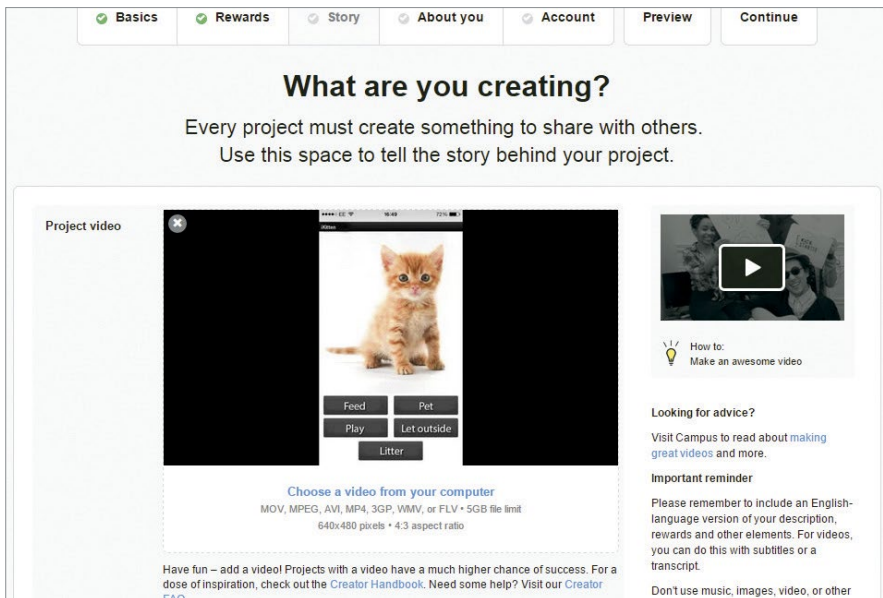
DESCRIBING YOUR PROJECT

Your project page needs to inform potential backers of what your idea is, why they want it, and how you'll go about realising it. When it comes to choosing a title, think SEO: include the project name, but also a few words describing your product or service, so visitors can find and understand it at a glance.

There's no set template for the description, but aim to be clear and concise; think more along the lines of an elevator pitch than a detailed business plan. Avoid excessive technical jargon: you want to appeal to everyone, not only specialists in your field. It's a good idea to get a friend to read over your project information before you submit it to the site, to check that your message is clear and understandable.

Think about presentation too: Kickstarter's text editor supports headings and bullet points, so make use of these to break up paragraphs and direct your reader's eye to what's important. You can link to a project website for further information, and embed JPEGs, PNGs and other image types. Design drawings, mock-ups and screengrabs can be useful aids to convey a complex or unusual idea. Keep your text fairly light – backers can

The screenshot shows the Kickstarter homepage. At the top, there's a navigation bar with 'Discover', 'Start', and 'Search Projects'. Below this, the 'Staff Picks: Journalism' section features a project titled 'Meet the Composer | Season Two' by Q2 Music, which is 100% funded with \$20,147 from 337 backers, with 21 days to go. To the right is a sidebar with various categories like Art, Comics, Crafts, etc. Below the staff picks, the 'What's Popular' section displays three projects: 'The Bitmap Brothers: Universe' by Darren Wall, 'Meld: A Perfect Meal Every Time' by Meld, and 'Hansen vs. Predator' by Chris Hansen. Each project has a 'See all' button next to it.



^ Short videos about your product or idea are a great way to engage potential backers

always contact you through the site to ask questions if they require more information.

MAKING A VIDEO

Most Kickstarter projects include a video, which can be an efficient and engaging way to introduce your project to backers, to demonstrate how your product or service works in practice, and let people know a little about you. There's no need to invest in a professionally filmed video: many successful projects have been shot on a phone camera in somebody's front room, so just get the message across.

You can upload footage in almost any major format, but there are a few gotchas to look out for: Kickstarter uses a 4:3 aspect ratio, rather than the more common 16:9 widescreen format, and there's a maximum file size limit of 5GB. This shouldn't be a problem since it's a good idea to keep your video short: two minutes or less is a good length for which to aim.

When it comes to content, footage of yourself (or a member of your team) speaking directly to the audience is more appealing than an anonymous voice-over, but also include images or video footage of your product in development, to help backers visualise the idea.

SETTING THE RIGHT FUNDING TARGET

Setting the right target is key to the success of your campaign, so spend some time considering what your project requires to get off the ground and from where that money is likely to come. Take a look at recent successful campaigns in

your area of interest – again, Kicktraq can help you here. Don't just examine the total funds raised but also note the number of backers and the most common sum donated. Together, these will provide a good ballpark figure to aim for and the kinds of rewards to offer.

When your campaign is over, Kickstarter will use payment partner Stripe (stripe.com) to automatically collect payments from backers, who will need to enter card details in order to make a pledge. Note that some other crowdfunding platforms require backers to have a PayPal account from which to collect money – check that the payment method used is suitable for your donors.

✓ Kicktraq provides useful information on current and past Kickstarter campaigns

If you're already a well-known company with an established customer base and a good reputation, you should have no problem reaching potential backers. If you're a small startup or an individual making a first foray into business, your backers are more likely to come from personal contacts: multiply your friends and acquaintances by a typical pledge to get a realistic target figure. See our advice below for tips on how to get the word out and start people backing your project.

REWARDS

Kickstarter rewards are the benefits you offer your backers to attract them to your project. They're usually something associated with your project, such as an advance copy of your finished product, sent either physically or via digital download, or merchandise.

For low-level donations, consider offering rewards that are either free or very low cost to produce and distribute. "Digital rewards" are perfect here: that might mean a personalised message of thanks on social media, imaw ges of your project in progress, or a thank-you video from your team. If you're distributing physical rewards (including advance or reduced-price copies of your product), triple-check you've built their costs into your funding target, or you may find you're left with a big hole in your budget.

BE INVENTIVE

Most Kickstarter creators distribute rewards at the end of a campaign, but there's nothing to stop you posting digital rewards while the campaign is running. This can help to create a buzz around your campaign, especially if you make



the reward a video or image that the recipient is likely to want to share online.

LAUNCHING THE CAMPAIGN

Before you go live, it's a good idea to have an initial group of donors primed (perhaps some good friends, loyal customers or members of your board) to pledge as soon as the campaign goes live. This helps get your funding thermometer off the zero spot and gives your project the sheen of success. Email your most likely backers to let them know when your campaign will launch, and email again when it's live.

This is also the time for a big push on social media. As with all social media ventures, timing is key: choose a time when your target audience will be online and available to click through, read about your campaign and watch your video.

PROMOTING AND UPDATING YOUR CAMPAIGN

Potential backers may not immediately jump at the opportunity to support your campaign, but repeated exposure can win them over. A daily summary on Facebook is a good way of keeping your project visible, and don't be afraid to ask your backers to share the campaign on their social media – reaching beyond your own immediate circle of contacts is key to getting the Kickstarter ball rolling.

Also consider setting up a dedicated Facebook page for your project where you can post images, videos and acknowledgements from your backers, and invite those who are likely to support you to the group. Share content on your personal feed as well and encourage your team to do the same – support can come from unexpected quarters!

KEEP IT REAL

Genuine communication and real enthusiasm go a long way, so combine scheduled updates with personal posts thanking donors – unless a donor has asked to be anonymous, it's good practice to put a name on Twitter and Facebook, which not only says thank you, but also reminds people that your campaign is running. Don't neglect your Kickstarter campaign page either. When you add an update here, Kickstarter will automatically send it out as an email to existing backers. Advertise when you've hit a milestone (such as 50% funded and 75% funded) to raise confidence in the project going forward, with the aim of

forcing floating donors off the fence.

Aside from social media, draw up a list of key contacts (such as existing customers, industry contacts or close colleagues) and plan out regular email contact with them. Tools such as Boomerang and MailChimp are good for scheduling and sending mass emails. If you're targeting particularly wealthy or

influential people it's best to craft an individual email approach.

You'll also find support and advice via online forums. As a first port of call, try the Kickstarter forum on Reddit (www.reddit.com/r/kickstarter/) – this active forum of more than 25,000 members can help boost interest in your project. Cross-post to other forums related to your project area: enthusiasm from Reddit has been credited in the success of high-profile campaigns including Cards Against Humanity and Exploding Kittens, among others of note.

Kickstarter's Creator Dashboard will show you a breakdown of daily funding progress and pinpoint from where your web traffic is coming, so you can analyse how effective each email, tweet and Facebook post is to your campaign. If you want to share daily goals with your customers and friends, embed the Kicktraq Mini widget onto your website or forum to show off how well you're doing.

AFTER YOU'VE HIT YOUR TARGET

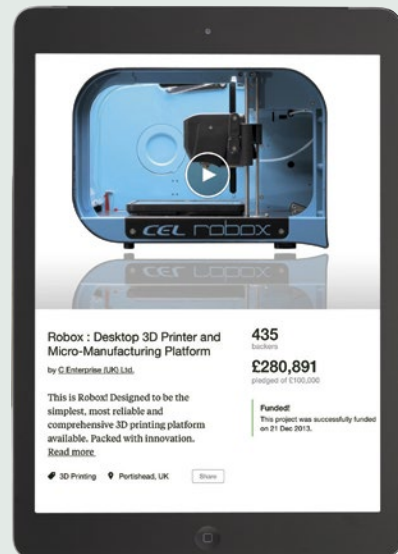
If you hit your funding target before the end of your campaign – a common occurrence as the public gets used to the idea of Kickstarter – there's no need to stop campaigning. Now's the time to update your backers and make them aware of your "stretch goals" for any extra money raised. If you show how you'll include extra funds in an updated business plan, chances are you'll continue attracting backers until the end of your campaign.

Nor should the end of the campaign mark the end of your activity. You can continue to post updates on your Kickstarter page to keep backers informed about how your project is developing, and the delivery of any outstanding rewards. If production is delayed or it's taking longer than anticipated to complete the work, let them know why – in general, donors will understand a change of plan, but won't appreciate being kept in the dark. ●

4 WAYS TO KICKSTART YOUR CAMPAIGN

KICKSTARTER FOR IOS/ANDROID (FREE)

Monitor donations and send campaign updates from wherever you are with Kickstarter's official mobile app. At present you still need a desktop computer to launch or edit your campaign.



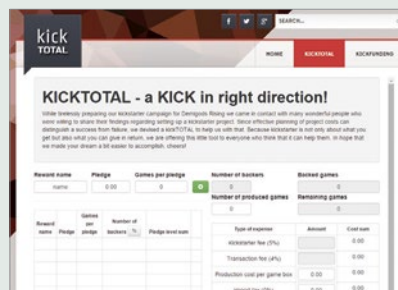
BOOMERANG FOR GMAIL

(unlimited, from \$5/mth)

Craft personal emails and send them to potential backers at the ideal time of day with this email-scheduling tool.

KICKTOTAL (www.kicktotal.com/kicktotal2)

This handy web service lets you tot up your project's costs, along with fees, the cost of any rewards and expected sales revenue, to ensure your fundraising finances stay on track.



BACKERKIT (US\$99/mth)

If your project attracts very large numbers of backers, BackerKit can help you track backer contacts and manage rewards – including those that aren't offered through Kickstarter.



MAKE WINDOWS ADMIN EASY WITH POWERSHELL



Windows' next-generation scripting host can save you time and effort when it comes to managing PCs. **Jonathan Noble** introduces PowerShell

Computer management involves a lot of repetition. Whether you're supporting a multinational corporation, or just helping out friends and family, you probably find yourself doing the same tasks over and over again. You might even have a collection of utilities that you've carefully curated over the years to help you deal with the issues you come across regularly. If this sounds familiar, then one addition to your toolbox that will prove invaluable is PowerShell.

PowerShell is basically a scripting language and an interactive shell. In that way it's similar to the familiar command prompt, or the Windows Script Host that handles JScript and VBScript files. It's more powerful than either, however: there are things that you might want to do in the Windows ecosystem that can only be achieved with PowerShell.

Why's that, you ask? Well, several years ago, Microsoft decided to make PowerShell its preferred administration automation tool. So now, if there's anything being developed inside the company that offers a management interface, that interface will be made accessible from PowerShell.

In practice, many product groups inside Microsoft actually develop their PowerShell interface first, and then build a graphical interface on top of that. Some products, such as Microsoft's recently announced Nano Server (for cloud-scale infrastructure workloads) don't have an external interface. So PowerShell is the most versatile, and sometimes only, way to manage OS components.

Inevitably, getting started with PowerShell involves a learning curve. But it isn't difficult: if you find yourself repeating the same processes over and over again, the time it takes to automate the task in PowerShell quickly pays off. A guy I know who was a Microsoft Premier

✓ The PowerShell ISE is a rich scripting environment

Field Engineer once told me that he loved PowerShell because it gave him more time to spend with his family.

POWERSHELL SYNTAX

The PowerShell language is object-oriented, and in fact uses the same objects as other languages built on the .NET framework – so if you're already familiar with C# or Visual Basic, you have a head start. If not, you don't need to worry about it.

What you do need to know is that the basic units of functionality in PowerShell are called cmdlets ("command-lets"). Each cmdlet has a name structured as "verb-noun" – examples include Get-Command and Copy-Item. As you can see, the commands are generally understandable in plain English, although there are a few exceptions, such as "ForEach", which is a verb in PowerShell. The language uses a limited number of verbs, so the syntax is quick to learn: if you want to retrieve some information, you know it's always going to be Get-something.

When you launch the PowerShell Integrated Scripting Environment (ISE), you'll see a pane on the right-hand side full of cmdlets, along with some built-in aliases and functions (which are like mini-scripts). This pane can be used to search for valid keywords, and to help you find the command you need. You can also filter the list based on modules – essentially, packages of cmdlets, functions and so forth that relate to a particular task. As you develop your PowerShell skills, and start writing your own functions, you can bundle these together in your own modules, and share them with colleagues or the wider community.

You can also make a list of the cmdlets available to yourself by running Get-

✓ A few simple commands illustrate object-oriented syntax

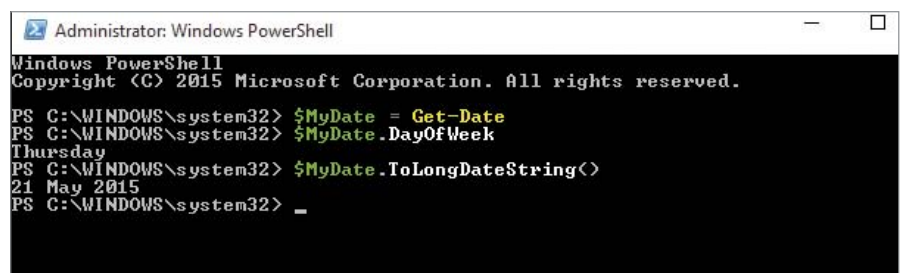
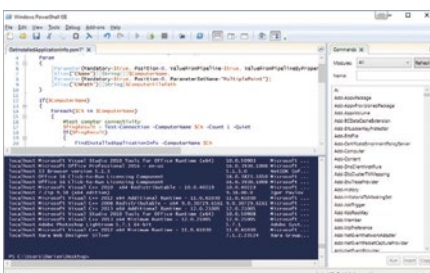
Command. This is one of the most useful cmdlets to remember, because it lets you explore the wider PowerShell environment and work out everything else from there. Another important one to know is Get-Help, which provides guidance on using the available cmdlets: for example, to learn more about Get-Command you'd simply enter "Get-Help Get-Command". The first time you run Get-Help without any parameters, it will walk you through the process of downloading local help files for all of the modules and core features, using the Update-Help cmdlet.

Get-Help isn't limited to defining cmdlets; it can tell you about other aspects of PowerShell language too. "Get-Help About_If", for example, will show you how to use the If statement in a script. You can see the full list of topics by running "Get-Help About*" – you'll find content about variables, loops, conditional statements, error handling, operators and many more advanced capabilities.

USING A CMDLET

To see how cmdlets work, let's look at a commonly used cmdlet: Get-Date. Type it at the command line and you'll see today's date. As I said earlier, however, PowerShell is all about objects, so what appears onscreen is actually a representation of a .NET System.DateTime object, which is far more functional than a mere string of text. It comes with a bunch of properties, which include the current time, day of the week and the day of the year, and also exposes a number of methods that we can use for formatting the date in a particular way, for example, or comparing it to another date, or checking whether it falls within a daylight savings time period.

To see how this works, let's load the date into a variable – we'll call it \$MyDate – and then access its properties



and methods by entering the following commands:

```
$MyDate = Get-Date
$MyDate.DayOfWeek
$MyDate.ToLongDateString()
```

The above commands will output the day of the week for the current date, and then output the whole date as a string with the month as a word.

Collectively, the properties, methods and other features of an object are called its members; if you want to find out what members an object has, you can use – predictably enough – the Get-Member cmdlet. We pass our object to the cmdlet using a “pipeline”, which lets you use the output of one command as the input for another. So, to see what members \$MyDate has, we’d pipe it into Get-Member as follows:

```
$MyDate | Get-Member
```

This is more or less the simplest possible use of a pipeline, but you can easily create longer pipelines that feed one or more objects between multiple cmdlets:

```
Get-Service | Sort-Object Status | Format-Table Name,Status
```

In this case, Get-Service outputs a collection of Windows services as objects; these get passed to the Sort-Object cmdlet, which organises them by status (that is, whether the services detailed are running or not) before passing its output to the Format-Table cmdlet, which generates a table containing the name and status of each service. It’s worth noting that Format-Table actually changes the type of the objects that pass through it: it outputs a bunch of internal formatting objects that are passed invisibly to another cmdlet called Out-Host, which displays them on the screen.

Knowing the three cmdlets Get-Command, Get-Help and Get-Member can take you a long way. Let’s throw a fourth into the mix: Get-PSDrive, which can be used to enumerate the drives on the machine. This naturally includes local hard disks, but there are interfaces to other resources too: the Registry provider, for example, provides access to HKEY_LOCAL_MACHINE and HKEY_CURRENT_USER as PSDrives. This means that you can do cool things like “cd HKLM:\Software”, see what’s there with “dir” and modify things with Set-ItemProperty. Try running Get-PSDrive on your system to see what comes to the surface – some products install their own providers and

you might be surprised at what you have access to.

ALIASES AND ABBREVIATIONS

In the example above, you might have noticed that “cd” and “dir” don’t follow the PowerShell verb-noun format. These are actually aliases, which are included to help people who are more familiar with using command prompt or Unix-type shells on other systems. The cmdlets they access are called Set-Location and Get-ChildItem, but who wants to do that much typing? If you have a Unix background, you can also use “ls” in place of Get-ChildItem. I’d tell you how you can find a full list of aliases, and how to make new ones, but by now you should be able to work it out for yourself.

PowerShell also lets you abbreviate keywords, as long as there’s no ambiguity. As an example, here’s a command that accesses the Windows event log, extracts any events of the type “Error”, and then pipes the results into table format:

```
Get-EventLog -LogName System
-EntryType Error | Group-Object source |
Sort-Object Count -Descending | Format-Table Count,Name -AutoSize
```

You could get exactly the same effect by typing the following:

```
Get-EventLog -Lo System -E Error | Group
source | Sort Count -D | FT Count,Name -A
```

The shorter version isn’t half as easy to read though!

DESIRED STATE CONFIGURATION

I can’t let you go without mentioning Desired State Configuration. DSC is a feature that was added to PowerShell with the release of Windows 8.1, and if you manage Windows servers it’s something you need to know about.

Before DSC, PowerShell was imperative, meaning that you ran some commands, or a script, and you got back some results. DSC is a declarative expansion of the PowerShell language that lets you define the state a system should be in, without necessarily specifying how to get there. DSC’s Local Configuration Manager can then check periodically whether your system is still in the desired state; if it’s not, it takes steps to put it back how it should be.

This is incredibly useful if you’re managing a large infrastructure, where configuration drift can go unnoticed. Even if you’re looking after only a few systems, having confidence that critical items are going to stay in the correct state is important too. ●

GETTING STARTED WITH SCRIPTING

To create a PowerShell script, you can open the Integrated Scripting Environment directly from the Start menu (or Start screen if you’re using Windows 8). By default it will open with an interactive command line; click the New icon or press Ctrl+N to open a new script-editing pane, into which you can type your code. Here’s a sample script for removing multiple Windows Store apps:

```
# When the Gridview control pops up,
you can select multiple apps by shift/ctrl
clicking
Get-AppxPackage | Out-GridView -PassThru
| ForEach-Object{
    $AppName = $_.name # In a ForEach
loop, $_ is the current object
    Remove-AppxPackage -Package $_
    -Confirm # The Confirm parameter is a
safety net
    # Some built-in apps can't be removed,
so let's check that
    If ($?) { # $? is a handy built-in variable
to tell you if the last thing worked
        "$AppName was removed."
    }
    Else {
        "$AppName could not be removed."
    }
}
```

You can run or test your script by clicking the “Play” toolbar icon, or hitting F5; a shortcut with which you’ll be familiar if you’ve used Visual Studio. The output appears in the command prompt pane. When your script is complete and working, it’s time to save it. The standard extension for PowerShell scripts is PS1 (although in Windows 10 we’re now up to version 5 of PowerShell, Microsoft decided to leave the extension the same after version 1). There’s no official standard location for PowerShell scripts, so just put it somewhere convenient. If you begin writing lots of scripts you might want to collect them into a folder and set up a profile for yourself that automatically looks in that folder for scripts: to learn more about this, try Get-Help About_Profile.

Once your script is saved, you can run it by entering its name in the PowerShell command prompt. The first time you try it, though, you’ll see an error message: as a security measure, PowerShell scripts are disabled by default. You can change this by entering Set-ExecutionPolicy Unrestricted – but note that you’ll need to be running PowerShell as an administrator to make the change.



NEIL CHANDLER DATABASE ADMINISTRATOR

We look at jobs in IT and talk to someone in the field

WHAT IS YOUR JOB?

I design, build, monitor and run relational databases, generally using Oracle, but sometimes with Microsoft SQL Server. I'm working in the financial sector, but almost all corporations use databases, so a database administrator (DBA) might work in any industry.

Some DBAs work on the development side, focusing on design and performance, while others are more concerned with data availability, disaster recovery and storage layouts. In very large organisations, such as tier-one banks, these will be two separate functions; in smaller organisations, one team might be responsible for it all.

WHAT SKILLS DO YOU NEED?

To build a database, you need knowledge of a business' requirements for availability, performance and so forth. You also need a grasp of the technology: memory access, storage tiers and data partitioning. I'm currently working on a stock-market trading system, which requires rapid response times for some parts.

WHAT DOES A REGULAR DAY LOOK LIKE?

Much of the daily routine is a response to: "We've got a problem – can you fix it?" This morning, I've been working on a system from which we wanted to extract the data more quickly. I spent time diagnosing a problematic SQL query, and after making a small change to the system, the data is now coming out in fewer than three milliseconds.

Another thing I did this morning was to ensure that everything was working the way it's supposed to be working: whether backups have run successfully, for example. You may go through a runbook of "Is A working? Is B working?" and so on, fixing anything that isn't working as it should. You can use Oracle's management and monitoring system, Cloud Control, to help with the day-to-day alerting and administration.

IS THERE A LOT OF OUT-OF-HOURS WORK?

Very much so. This past weekend we had a serious issue come up, so after a 50-hour week I ended up putting in a

19-hour weekend. I think I've been woken at three in the morning in every DBA job I've had. Also, changes to systems may need to take place at unsociable hours, when there's less demand. Larger organisations often have a rota of DBAs, so you might only be on call for one week each month.

There are external activities a DBA could be involved in too, such as the Australian Oracle User Group (AUSOUG) – a large professional group, where you basically get a whole load of geeks together in a room, talking about Oracle, with presentations by senior DBAs. These are like mini-training courses. Organisations and individuals have to pay to join the AUSOUG, but there are free groups such as #ClubOracle which tend to be sponsored by consultancies. There's also an SQL Server user group called SQL PASS.

HOW DID YOU GET INTO THIS LINE OF WORK?

To become a DBA you tend to start as either a server administrator or a developer; I chose the latter. I used to write assembler code on IBM mainframes a long time ago, and then, as often happens in smaller firms, I found myself being asked to take on additional tasks. One such task was Oracle database administration, which I enjoyed more than coding. Rarely do people come into database administration directly from a graduate programme, although it does happen.

WHAT ARE THE DOWNSIDES?

As I say, you tend to be very much in demand. At 6pm last night, just as I was leaving the office, one of the managers asked, "excuse me, can you help me with this?" That's very common.

Keeping up to date also takes some effort. I've been working on Oracle for more than 20 years, and it's a continual learning process. It changes rapidly, so much so that it scares you.

WHAT ADVICE WOULD YOU GIVE TO SOMEONE INTERESTED IN BECOMING A DBA?

If you already work in IT, shadowing DBAs would be a good place to

start. You can learn a lot that way, and from online resources too; websites such as Ask Tom (asktom.oracle.com) and SQL Server Central (sqlservercentral.com).

It's also worth getting an industry certification, because that will make you a more saleable commodity. It's a big commitment, however: you have to pass five exams to become an Oracle Certified Professional, and take at least one instructor-led class. Certifications also expire, so you have to renew them every few years. The SQL Server MCSE route isn't any easier.

WHAT'S THE PAY LIKE?

An Oracle DBA in a major city will happily earn around \$90,000 a year – and when they become senior and gain a significant level of expertise, they can have a package in excess of \$140,000. But to become a truly excellent DBA, and to earn that sort of money, you'll have to dedicate some of your personal time. ●

WHERE TO START

- Oracle Database Concepts for each Oracle release – available online, and it's free
- Effective Oracle by Design by Thomas Kyte
- Oracle Core: Essential Internals for DBAs and Developers by Jonathan Lewis





The best reason to buy an iPad

Your other favourite technology magazine now has an iPad edition featuring everything you love in the magazine plus exclusive extras each month including additional photography and video. Change the way you view your tech. Head to iTunes now to download the app.



USE 3D PRINTING TO BUILD THE HOUSE OF YOUR DREAMS

Yes, it really is possible to 3D-print a house – and one firm is already producing personalised homes. We spoke to Facit Homes' managing director, **Bruce Bell**, to find out how computer-guided manufacturing adds to the house-building process

There are many examples of 3D-printed construction around the world: China is home to the first 3D-printed apartment building, and a 3D-printed estate, complete with swimming pool, can be found in New York. Now, Facit Homes is building a 3D-printed home in London's Highgate. We spoke to managing director Bruce Bell for an insider's guide to the technology.

How does the technology work? Is it really "3D-printed"?

"People like to use the term [3D printing]," Bell said, but revealed that he tries to avoid it. "But it makes sense in a way, because you're using a computer... and you're getting components that are an exact replica of what you see on the screen. Conceptually, it's the same thing."

However, the actual production techniques employed to build homes aren't the same as those used to print everyday 3D objects. Instead, Facit's architects design the homes in 3D on a computer, and then use those files to build personalised pieces of the housing puzzle, with a computer-controlled blade cutting through wood and other materials to create pieces that are then assembled into the final structure.

Why is this a better way to build homes than standard techniques?

According to Bell, the upside to handing over manufacturing to computers is that they're more precise than the average human builder – although the end product is still assembled by people. "The thing with homes and construction is it's done by hand. And as soon as items are made by hand there's a lot of interpretation... and uncertainty."

✓ Building a 3D-printed home is like putting together a huge puzzle



He compared the manufacture of homes to other products, from bikes to cars to iPhones, which are designed on a computer, after which the resulting 3D file is passed to machines that "translate" it into an object. "And that's why these products are so good, because they've never been touched by human hands," he said.

"So, for our customers, it's about guaranteeing that they're going to get what we've told them they're going to get. It's cutting out the human interpretation you get in the traditional construction process; it's taking what people see in consumer products and bringing that to the construction industry."

How do your homes differ from standard-built houses?

"It allows us to do more with less, in terms of design and finance," Bell told us. "We can spend more time designing it; focus on details and fabricate items that you couldn't otherwise do using a traditional process."

This includes work on the core of a building, dubbed the chassis, to which other pieces are fitted. Items such as lighting fixtures are built in from the ground up, while insulation, electrics and plumbing have their own separate cavities in walls to ensure that workers

✓ Using digital tools allows you to spend more time on the design of a home



▲ Interiors are designed and built digitally too

are confined to only those areas, interfering with the finished product as little as possible.

The interior, too, is designed with 3D precision. "We'll do staircases, kitchens and canopies; all these items have been digitally designed and digitally manufactured."

The house in Highgate features a laser-cut steel staircase and windows that line up with ventilation stacks, while other homes designed by Facit feature built-in under-floor heating, hidden sound systems and underground swimming pools – all impossible in prefabricated homes, or very expensive using traditional methods of construction.

"We can use these digital tools to get something that's super-tailored and built around people's lives," Bell said. "These tools allow us to be flexible and achieve what people want – as opposed to a building system that might be limited." ●



WHAT IS... TESLA'S POWERWALL?

Elon Musk has been breaking boundaries again: this time he's launching a smart-home battery system that stores cheap or solar energy to be used later

Elon Musk wants us to drive electric cars, travel through supersonic Hyperloop tubes, and spend our holidays in space – and now he's turned his attention to home energy. His company Tesla has unveiled a home battery system called Powerwall that lets you store solar energy to power your home.

IS POWERWALL THE FUTURE OF ENERGY?

Musk thinks so – and so do tens of thousands of others who have pre-ordered the battery.



A BATTERY? PEOPLE ARE EXCITED BY A BATTERY?

They are – Musk claims that 38,000 people have already signed up for what is, essentially, a giant rechargeable lithium-ion battery. They're hoping it lives up to Musk's promises of being less battery and more home-energy-management system.

AND WHAT MAKES IT SO SMART?

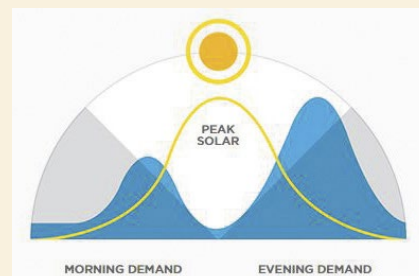
The Powerwall is charged via solar panels, storing energy from sunny mornings to use on grey afternoons or at peak-use times. It also lets users top up from the electric grid, so if your panels aren't pulling in enough power to meet your needs, you can fill up your Powerwall at non-peak times when rates are low for use in the evenings. Hey presto, lower utility bill. Aside from storing solar and load shifting, it's also handy as a backup power source in the event of an outage.

HOW MUCH WILL THIS BILL-CUTTING BATTERY COST?

The 10kWh Powerwall costs US\$3,500 and can hold charge for a week, while the 7kWh version is US\$3,000 and recharges daily. That doesn't include installation however, nor the cost of installing solar panels. Musk admits the price is too expensive for the mainstream US market, and is clearly hoping to drive it down over time.

THAT'S A LOT FOR A BATTERY.

True, but it really is big: it weighs 100kg and measures 86 x 18 x 130cm, offering



up to 8.6A of peak output. The Powerwall can be installed inside or out, working at temperatures between -20°C and 43°C. If you're worried about having a big ugly box attached to your wall, fear not: Tesla has designers that Apple would envy. The Powerwall is a sleek, shiny rectangle that wouldn't look out of place on a spaceship.

ELECTRICITY COMPANIES AREN'T GOING TO LIKE THIS, ARE THEY?

Possibly not, but some punters have suggested they may be the means through which many of us get the expensive Powerwall system installed in our homes, much the same way many energy companies give out pricey smart meters, which cut usage but keep us as loyal customers. Plus, Tesla is pushing its batteries to utility firms to help manage their power, and to businesses to avoid peak charges.

WHEN CAN WE GET A POWERWALL?

Deliveries in the US will begin this summer.

CROWDFUND THIS! CREATORKIT PRINTEDTOUCH STICKERS

Our pick of tech projects on Kickstarter and Indiegogo

What is it?

PrintedTouch stickers feature conductive ink on the rear, enabling you to build interactive devices that play sounds when you press them. It's a great way to teach programming basics to children, and the stickers have also been used to add track samples to posters and album covers. These are stickers you'd actually want to collect.

Why would you want conductive stickers?

The technology allows you to make pretty much any surface interactive – so you can make posters that speak when you prod them, or floors that play music when you tap a spot. The CreatorKit bundle includes printed touch stickers, control modules, battery packs

and software to set up your program.

How does it work?

Conductive ink on the back of the sticker behaves like wires, while the front has capacitive touch sensors. They're sticky on both the front and back, so you can fix them to a surface and add a graphic to the front. To make them play a sound, simply press a control module into the right spot on the sticker along the conductive ink, and do the same with the battery pack and sound actuator, which turns the surface into a speaker. Then, use the software or decide what the sticker will do.

Save the file to a microSD card, plug that into the control module, and then you're done.



How much will it cost?

You can try out the system by building your own "piano". For \$30, you get stickers with a piano graphic on the front, and a control module that plays key sounds on the back. For your own project, you can buy four page-size stickers and a control module for \$44. For more advanced users, the Creator Studio offers more modules and stickers, as well as a line-out to connect speakers, plus conductive tape and conductive ink for \$260.

Likely to get funded?

At the time of writing, the project had 49 backers pledging \$4514 of the \$24,000 goal. Delivery of the PrintedTouch Stickers is expected in September.

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ASHAMPOO WINOPTIMIZER 11

Ashampoo WinOptimizer 11 is a very comprehensive PC cleanup, maintenance and optimisation suite.

If you're short of hard drive space, for example, the program can remove leftover Windows and application files, surplus browser traces (IE, Firefox, Chrome, Opera and Safari), unnecessary duplicate files and broken shortcuts. A "Disk Space Explorer" helps you find other space-hogging folders, and the program can even defrag the drive when it's done to ensure you're getting the best possible performance.

An array of other speedup modules help to control your Windows startup programs, highlight and disable unnecessary services, optimise your internet connection, clean and defragment your Registry, remove unwanted applications, manage running processes, and more.

WinOptimizer includes a whole library of maintenance modules, including tools to benchmark your system speed, monitor drive health, control file associations, edit Explorer context menus, save and restore your desktop icon settings, and split, join, encrypt, decrypt, wipe and undelete files.

REGISTRATION & INSTALLATION:

- Download and run `ashampoo_winoptimizer_11_19384.exe`
- After you launch the software, a prompt will appear requesting you to register.
- Click on "Get free activation key", this will open up a link in your default internet browser.
- Enter your email and hit the "Request full version key".

REQUIREMENTS:

- Windows XP, Vista, Windows 7, or Windows 8
- 200MB hard drive space

LIMITATIONS:

- Registration Required.

Note: Users who have previously registered an Ashampoo product, please log in.

Once you have logged in, go back to within the application and click "Request FREE full version key" again and fill out the prompts accordingly.

Copy and paste your license key into the application, press next and complete the installation process.

Congratulations! You have unlocked Ashampoo WinOptimizer 11

For support of this software, please direct your queries to: <https://www.ashampoo.com/en/aud/sup>



ABELSFOFT ANTILOGGER

AntiLogger is a specialist malware hunter with just one task: to detect and remove keyloggers, dangerous malware which can record everything you type.

The program's single-minded nature makes it very easy to use. There's no bulky interface to navigate, no dialogs to explore, not even a "Scan" button: simply launch AntiLogger and it immediately checks all your running processes for potential danger.

After just a few seconds AntiLogger will let you know if it's found any "loggers". These include programs which might legitimately capture keyboard input, so don't be alarmed if something has turned up, just click Continue for more details.

REGISTRATION & INSTALLATION:

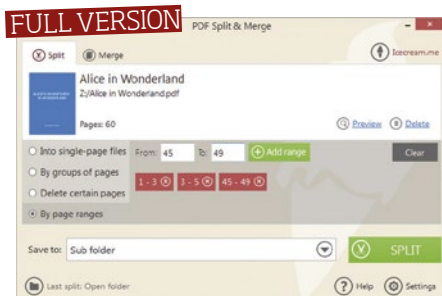
- During our testing of the application, we were not prompted for a registration key. However, we were given the following instructions:
- Get your registration code within the application. Note, if you have previously registered an Abelssoft full product, you won't need to register again.
- For support, please direct your queries to: www.abelssoft.net//kb

REQUIREMENTS:

- Windows XP, Vista, 7 or 8
- 50MB hard drive space

LIMITATIONS:

- Registration Required

**ICECREAM PDF SPLIT & MERGE PRO**

Icecream PDF Split and Merge is a tool for splitting PDFs, merging them, or just removing pages that you don't really need.

Surprisingly, the Split module can only handle one file at a time. But you do at least get plenty of control, with options to split your file into single pages, groups (sets of x consecutive pages starting from page y) and ranges (any specified range, like 3-9 or 12-14), while you're also able to delete any specified page numbers.

There's also some flexibility over the destination, with options to save your split files into a subfolder, the source folder, or some other folder of your choice.

Click Split when you're done and the program splits your source file almost instantly, then offers to open the folder for you to view the results.

REGISTRATION & INSTALLATION:

- Get your registration code at <http://pdfsplit.disc.pcauthority.com.au/>
- For support of this software, please direct your queries to: <http://icecreamapps.com/Manuals/>

REQUIREMENTS:

- Windows XP, Vista, Windows 7, or Windows 8
- 40MB hard drive space

LIMITATIONS:

- Registration Required

FULL VERSION + 6 MONTHS OF UPDATES

PANDA ANTI-VIRUS 2015

Panda Antivirus Pro 2015 is a powerful antivirus tool, highly rated by independent testing labs, which also provides a stack of extras to help keep your PC safe.

The program's use of smart cloud technology makes it lightweight, fast and easy to use. Most detection is carried out on Panda's own servers, so there's

minimal load on your system, and threats are blocked just as soon as they're discovered.

Antivirus Pro 2015 goes further, though, using heuristics and behavioural analysis to uncover and block even unknown viruses. And the results can be impressive, with labs like AV-Test and AV-Comparatives often giving Panda 100% protection scores during their 2014 tests.

REQUIREMENTS:

- Windows XP, Vista, Windows 7, or Windows 8
- 500MB hard drive space

LIMITATIONS:

- 6 Month License

FULL VERSION**XARA WEB DESIGNER 7 SILVER**

Xara Web Designer 7 Silver is a powerful web editor that makes it easy to create stylish, high quality websites, even if you've no HTML skills.

How easy? The program includes a Design Gallery that includes plenty of sample websites. Find one you like, double-click it and a complete multi-page site will open. Replace the text and images with your own content and you're done - the site could be ready in under an hour.

The templates are just the start, though. You can also customise your pages with new text panels, buttons, headings and more. The Design Gallery includes plenty of attractive clipart, photos and icons that you can drag and drop onto the page. And

there are all kinds of effects that you can apply to every area of a page, from giving text soft shadows, to creating mouseover effects (changing an image when a mouse moves over it, say), pop-ups (click a thumbnail to display the full-sized image), transparency and more.

After the first initial prompt, you will be asked to register for the product key. Follow the instructions on screen. For support of this software, please direct your queries to: <http://www.magix.com/au/support/>

REQUIREMENTS:

- Windows XP, Vista, Windows 7, or Windows 8
- 500MB hard drive space

LIMITATIONS:

- Registration Required. The Silver version is a little different to the Standard edition, such as a 10-page limitation, no Transparency or Shadow Tool and image import only.

FREE FULL VERSIONS: Each month, we offer *PC & Tech Authority* readers full registrable versions of some software on the DVD. See the installation instructions in the DVD menu to complete registration, if applicable. **IMPORTANT:** Full product registration closes on 10/08/15



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JON HONEYBALL

"MICROSOFT CLEARLY KNOWS HOW DEEP A BLACK HOLE IT CREATED WITH WINDOWS 8 AND IS DETERMINED TO CRAWL OUT OF IT"

Microsoft demonstrated some technical wizardry at Build 2015, but will it be enough to solve all the company's problems?

Microsoft unveiled more details about its Windows 10 plans at its recent Build conference. Many were reportedly enough to make the audience gasp, and to fill the blogosphere with an outpouring of extreme geek love. It's look at the upside first. Microsoft clearly knows how deep a black hole it created with Windows 8 and is determined to crawl out of it using Windows 10 as a ladder. As I've said before, many – even most – of the stupid mistakes that happened in Windows 8/8.1 are being addressed in 10, which can only be a good thing. It's too late to discuss how and why Windows 8 happened the way it did: that's for lecturers at business schools to pontificate upon to future students (which is, coincidentally, where Mr Steven Sinofsky went after Microsoft – he's an "executive in residence" at the Harvard Business School).

Let's put aside the fact that current builds of Windows 10 are still extremely wobbly, and that an awful lot is changing in what appears to be almost undue haste so late in the development cycle. The OS is due to slip out of the doors very soon, and I can't remember any major build of Windows that was still so reminiscent of a jelly in an earthquake at this point – hopefully everything will come together. I hear that the traditional post-release-update excuse is being polished ready for battle in the second half of this year, and things that are just not finished will appear in slow dribbles over the coming months.

There were a couple of bombshells at Build, though. First is the arrival of "bridges", which are technology systems

that enable you to run all sorts of things as native Windows applications, or native Windows Mobile applications depending on which bridge you care to stroll over. If you have Android application code, then this can be run on Windows Mobile. To take proper advantage of underlying Windows Mobile capabilities such as Live Tiles, you'll need to make a few nips and tucks to your codebase, but the idea is that you can bring in an Android app and it will run on your Windows phone, which is undoubtedly very clever stuff indeed.

The next one to wow the crowd was the ability to take iOS application source code and recompile it for Windows, both phone and desktop. In essence, Microsoft has built a code compiler for Objective-C that squirts out native Windows code. No-one has mentioned officially what will happen to those developers who have moved on from the ancient Objective-C to the far more modern Swift language, but rumours suggest that Microsoft will provide a cross-compiler for this too.

This is also very clever indeed, just like the Android support: making these things work needs some serious magic to happen in the background.

As one example, your Android app won't have Google's services to call upon, so Microsoft is building in a software layer wherein calls to those services will be morphed into calls to Microsoft services – so instead of getting Google Search, you'll get Bing (if your sphincter is starting to pucker up at the very thought of this, you're not alone). Both these bridges have been hailed in the most gushing terms as incredible and daring pieces of work, and just the sorts of thing that a post-Ballmer, reinvigorated Microsoft would be and should be doing. I'm way more cynical than that, however.

Let's take the cross-compilation issue first. This sort of recompilation to a different OS has been tried many times before and has never worked well. Think back to the days of OS/2,

✓ Microsoft's Build announcements caused an outpouring of geek love



JON HONEYBALL

Jon is the MD of an IT consultancy that specialises in testing and deploying hardware
@jonhoneyball



> The ability to run Android and iOS code on Windows is truly impressive – but will developers jump?

and its attempt to run native Windows code. Didn't work then, doesn't work now. Or rather, it works fine in a few carefully crafted demo applications – but the devil is always in the detail. The claim coming from Microsoft is suitably bullish. If you're an iOS or Android developer, then writing an application for Windows (or Windows Phone) is currently a rewrite job, and hence a lot of work. These technologies will give you a leg up by dramatically reducing the work required to get something going, almost down to nothing.

But let's look at the numbers. The first rule of retargeted code is that it's never as simple as it seems. For starters, you have to debug and support another platform, which you'll be doing through a smoke-and-mirrors layer provided by Microsoft. This layer won't be perfect, and you'll quite quickly end up working around multiple issues. Yes, you have a product up and running, but at what real cost? And is it worth it when, in the case of Android apps running on Windows Phone, we're talking 3% of market share? If you're already a successful app vendor on Android, why would you take on this additional headache for such a small sales uplift, even if it is simpler than doing a ground-up rewrite? The advantage of a ground-up rewrite is of course that it's native to the target platform, and so can take full unfettered and unfiltered advantage of its services.

Now let's look at the iOS issue. First of all, Microsoft doesn't control the underlying OS, and has no meaningful access to its codebase. We're on iOS 8.3 today with 8.4 in beta, and at the forthcoming Worldwide Developers' Conference we'll likely see early versions of iOS 9. Now let's add to the pot Apple's exceptional ability to persuade its users to move up quickly to the latest version of its OS. Back in February Apple announced that iOS 8 was running on 73% of all iOS devices, and that was only months after its arrival. It's clear that, unlike Windows users, iOS users move and move rapidly, and hence will move to iOS 9 just as fast.

Let's also not forget the lock that Apple has over its developer community. Want your app to stay in the Apple App Store? Then keep up with the latest technologies and standards. If you're not 64-bit, you're about to become history. Once again, Apple has huge power over its developers, and has proven to be ruthless in getting apps optimised for iOS 8. This ruthlessness



is sure to continue with iOS 9. So we have an application environment that's moving fast and isn't under Microsoft's control; an OS environment that's moving just as fast; and an Apple willing to do whatever it can to protect that. It certainly won't let its developers lag behind the pack just to keep their older codebases alive, in order to fit in with wherever Microsoft has got to by that point in time.

Finally, let's not ignore the implications of all this for battery life. What will happen to any real application running on a Windows phone or tablet when it's ported across using these technologies? Battery life is everything, and even the smallest of slips can and will decimate the battery life for your users. No, the problem with all of this stuff is that it's "geek porn", as the Americans like to call it. It's hugely interesting to developers because they love talking dirty, but the businesspeople backing those developers will be wary, while end users simply won't care.

Here's their choice: there's a bunch of Android apps you want to use, so you can either buy that new Samsung/Nexus/HTC today and have them run just fine, or you can buy a Windows Phone and have those same apps work to some degree, with unknown and

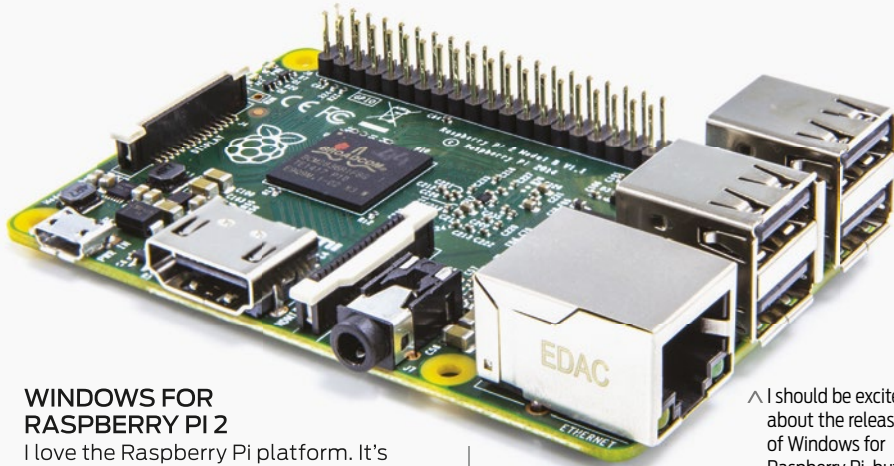
untested consequences on critical items such as battery life. That was an easy decision wasn't it? Or, if you're thinking of buying an iPhone or iPad, and have a bunch of iOS apps you want to use: you can either buy that new iDevice today and have the apps work just fine, or you can buy a Windows tablet and have those apps turn up sometime in the future, or not, when they might run well, or not. Well, that was another easy decision...

The really startling aspect of this technology is that it's Microsoft doing what it thinks it does best, creating wizardry for developers. Technical solutions that make bloggers drool. Unfortunately, think about what's actually happened. The company has singularly failed to get developers to engage at all with the touch interface of Windows 8.x. The failure of engagement with developers for Windows Phone has been even more catastrophic. All the market volume is in Android apps, and all the money is in iOS ones. So now it's offering up these porting tools with a pleading look in its eye, as if to say "look, we're doing everything we can to make things easier for you, please would you just even take a look?" That, ladies and gentlemen, is how deep the hole is. Developers for Windows touch tablets and Windows Mobile just aren't there. They're not listening. That boat has sailed.

It's truly galling to watch this from a company that has taken developers to the very heart of its being. It brought such empowering technologies as Visual Basic to the market; brought Visual Studio to fruition; excelled at language development and API innovation; even set the high water mark for application programmability with Visual Basic for Applications. And now it's essentially reduced to begging, which isn't nice to see.

✓ Microsoft has failed to get developers to engage with the Modern interface at all





^ I should be excited about the release of Windows for Raspberry Pi, but I'm not

WINDOWS FOR RASPBERRY PI 2

I love the Raspberry Pi platform. It's cute, does what it says on the tin, and is the embodiment of a distillation of good thinking down into a board that can almost fit in a matchbox. Some months ago I raved about how I could run Wolfram's Mathematica on a Pi, connected to my television via an HDMI cable. Now Microsoft has shipped an early build of Windows 10 for Pi 2, and I should be joyful. I should be shouting from the rooftops. But I'm not, and I'm curious to analyse why.

I think the problem comes back to that great big bear rampaging in the background – Microsoft's licensing policy. Yes, Windows 10 is going to be free for a year, and that's a good thing in so far as it will hopefully entice people to get up to date. But fees will kick in after that year. If you're a business user, Microsoft already has you by the short and curlies, and niceties such as "free upgrades for a year" certainly don't apply to you. This whole Internet of Things (IoT) concept is brilliant and hugely empowering, but follow the money. Do you think for one moment that Windows 10 on a Raspberry Pi 2 will be free to business users? Or for any sort of real work? Of course not.

That isn't the Microsoft way: it has to charge someone, and the great justification has always been the business case. So I'm becoming quite cautious about IoT, and how it will be implemented and paid for. A little more openness here would be a very good thing. Are they really going to make it free for any user, in any context? No, I can't believe that. And if they're saying that now, will they stick to it?

AZURE AND CLOUD

One place where I have only admiration for Microsoft is its implementation of cloud services, specifically Azure. The company is taking well-considered steps there, and growing the business furiously fast. Every time I look the price seems to have come down and the capability gone up. And it's not scared to talk about data storage on a petabyte scale, and of this

being applicable even to medium-sized businesses. I can't personally foresee any reason to move back to on-premise servers and Exchange Server. I have fast-enough internet connections now, the reliability of which is excellent. Office 365 has proved a superb solution, despite a few potholes in the road along the way. (Let's not talk about OneNote for Business for Mac, or my blood pressure will rise.) Kudos to the Azure team for continuing to press forward and not being frightened to innovate and compete head-on with the likes of mighty Amazon and Google.

APPLE WATCH

I can't close this month without a mention of the Apple Watch (see *PC & Tech Authority's* full review, p40). I own, and have used, just about every smartwatch. I like the Pebble, as it's cute and answers a core need for notification services on the wrist. It's cross-platform and does what it claims – I could be happy with it as a simple notification system. I didn't get on with Motorola's 360, since it only worked with Android, which isn't my well-worn mobile platform of choice (although I'll confess to usually carrying both the Samsung Galaxy Note 4 and the Apple iPhone 6 Plus with me, with the 6 Plus as my primary device). It just didn't click with me.

I bought a Microsoft Band when it went on sale in early April, but that lasted barely a week before being consigned to the dusty shelf. Maybe I have odd-shaped wrists, but I found the thing damnably uncomfortable to wear: hard and inflexible, and needing to have its display

> I've used every smartwatch out there, and the Apple Watch is the best

pointing downward to be usable at all – with the display uppermost, everything was pointed in the wrong direction. Notification services were adequate, and it's also cross-platform, but the discomfort made me discard it.

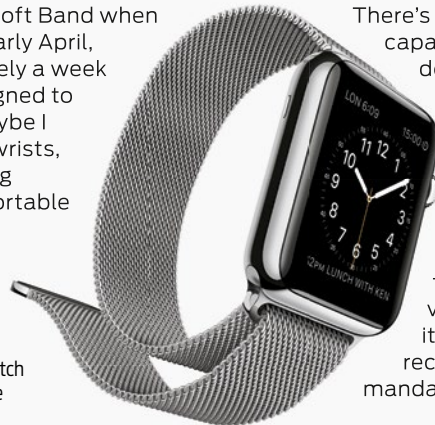
The Apple Watch is different. Within a few days I had almost 40 watch-enabled apps running on it, all doing interesting and useful things (although I'll draw a veil over the Tamagotchi applet). After a week I forgot to put the Watch on one morning, and for the rest of that day I was actively missing it. That's the sign of an interesting and engaging product. I charge it every night, but today is no different from usual: after around ten hours of my work day I still have 76% of battery life left.

It's the applications – the sheer flood of them – that make the Watch different. I'm able to personalise my Watch in a way that's similar to a smartphone, and that's the key differentiator. If you only want basic notifications, then the Pebble is your friend. If you want a whole different thing, the Watch is king. And Apple is following the same cautious path that it took with the early days of iOS. Developers can't write fully standalone Watch apps yet, but that will come once Apple has the confidence that it can police them properly, and that developers have the right tools to ensure a quality user experience. This is a platform that will develop at a very rapid pace, and it's going to be fascinating to, er, watch.

COLOUR CALIBRATION

If you need to colour-calibrate your screens, there's a new (to me) kid in town, and that's SpectraCal CalMAN. I've followed this tool for a while and recognised the strength it has on desktop monitors, TVs and projectors, but I also wanted to be able to measure Android and iOS mobile devices. Now they've released their Android tool, and the iOS one is in final testing.

There's truly comprehensive capability here, and it can do just about anything you might want or need. There are free and cheap versions, all the way through to a full lab-spec measurement platform. I've bought the full kit and am very impressed with it so far. Thus, my recommendation is mandatory. ●



PAUL OCKENDEN

"ONEPLUS HARDWARE AND CYANOGEN SOFTWARE MADE FOR A FINE MARRIAGE. OR SO IT SEEMED..."

A combination of high-end hardware and popular software made the Chinese OnePlus One a "flagship killer" – but all was not well at home

I've been castigated by a few readers because of my failure to revisit the OnePlus One handset following a promise to do so in my "China phone" column three months ago. There's a reason for my tardiness, however: as I hinted back in issue 210, big things were afoot at OnePlus, and so I should probably rewind the clock to look at a few factors that have got us to where we are today.

The OnePlus One was launched in April last year. Sales were slow, not through a lack of interest but because the manufacturer deliberately held back inventory, selling on an "invite-only" basis. I'll get to the specs in a minute, but crucial to this project was a tie-up with Cyanogen Inc, which provided the CyanogenMod version of Android that runs on the device: the handset even had Cyanogen's logo on the back. The combination of OnePlus hardware with Cyanogen software made for a fine marriage. Or so it seemed, until things started to go wrong shortly after the honeymoon.

CYANOGEN

You see, Cyanogen had been "cheating" on its partner (for any lawyers reading, I use that term purely for dramatic impact) and signed a deal with India's Micromax Mobile behind OnePlus' back, giving it exclusive rights to sell Cyanogen-branded products across that huge subcontinent. This was a market that OnePlus was obviously very keen to enter, so it must have been an unpleasant surprise when Micromax took out an injunction halting sales of the OnePlus One in India.

The love-in was over. The companies began trading insults, and now I think it's

> The OnePlus One used to have the Cyanogen logo on its back cover, but this has been removed in recent shipments

safe to say they're on their way towards a divorce. The Cyanogen logo has even been removed from the back of recent handsets. In fact, the whole Cyanogen Inc project is itself now mired in controversy.

CyanogenMod started out as an "enthusiast-developed" version of Android that adhered both to the letter and spirit of the open-source ethos, but in 2013 its founder Steve Kondik announced the setting up of Cyanogen Inc with venture-capital funding. The idea was to create an enhanced market

for the software – hence those deals with OnePlus, Micromax and more – but many of the people who had contributed to CyanogenMod felt this was a betrayal of the community nature of the project, and were against the apparent commercialisation of their work.

MICROSOFT ENTERS THE FRAY

As if that weren't controversial enough, in January this year it was announced that Microsoft had made a huge investment in the company, and in April a far more



PAUL OCKENDEN

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< Even the
OnePlus' data
cable has a
premium feel

strategic alliance was trumpeted that included the bundling of Microsoft's apps with future versions of Cyanogen Inc's OS. I can only imagine the expletives uttered by many of the open-source collaborators when they heard about this deal: many of them see Microsoft as everything that's wrong with the world of software.

So where are we now? Well, rather than get stuck with hardware but no software, OnePlus has created its own version of Android called OxygenOS, which it achieved by hiring the key people behind the highly respected Paranoid Android distribution. It's a fork from Lollipop, with a set of quite light and subtle changes, and it's specifically geared towards the OnePlus One (and also the OnePlus 2, which should arrive later this year).

However, putting OxygenOS onto an existing OnePlus handset isn't exactly a consumer-friendly operation: it involves unlocking the bootloader; then flashing a recovery such as TWRP onto the device; booting into recovery mode; wiping device caches; flashing new firmware; rebooting; recreating things such as email accounts that aren't backed up by Google; and finally reinstalling any applications that weren't downloaded from Google Play. That's surely an obstacle course at which even the most technically minded user might balk.

MAKING IT IDIOT-PROOF

This brings me neatly on to option two, because despite their epic falling-out, Cyanogen is still under contract to provide OS updates for the OnePlus One, and that's exactly what it's done with CyanogenMod CM12S. Again, it's a forked version of Lollipop, but with many more bells and whistles this time. It's more customisable than standard Lollipop, features better privacy protection, an enhanced email client, productivity tweaks to its user interface and controls... I could go on, but it's quite a long list. The great advantage of CM12S, however, is that it's available as an over-the-air (OTA) update for existing

devices, without any messing around unlocking bootloaders and flashing recoveries. It probably even passes the "could your nan do it?" test.

After having tried both OxygenOS and CM12S, I can say that they're both very good, but I prefer the latter. I've come to rely on some of CyanogenMod's added bells and whistles. In particular, the

"It's hard to quantify or put into words, but the OnePlus One just feels like quality kit"

camera app in CM12S is far better than the one in OxygenOS, and the themes engine is great for people who like to personalise their phones.

FLAGSHIP KILLER

That's enough about the software – what about the hardware? When OnePlus One was launched, the company rather arrogantly billed it as its "flagship killer", pitching it against the best that the likes of Samsung, HTC and Sony had to offer. On paper this comparison kind of works, since the specification is very good and its price is exceptional. It costs around \$500 for a 64GB phone, which was stunning value at the time and is still reasonable today. A year down the line, the device struggles to maintain "flagship killer" status, if only because new flagships have arrived, but it's still capable of mixing with the big boys. I'd say it's a good equivalent to the Samsung Galaxy S5 or the HTC One M8.

One area in which it shines is build quality: its mock-sandstone back cover and solid construction make it feel as if you have a premium device in your hand. It's hard to quantify or put into words,

but it just feels like quality kit. Even the packaging has a premium feel, and the USB cable isn't the usual cheap tat. Battery life is great too.

One possible weakness is that, although the phone is 4G-capable, it doesn't support LTE band 20 (800MHz).

You no longer need an invite to buy the OnePlus One; you can order it directly from the website, and it usually ships quickly. When the OnePlus 2 launches later this year, I expect the invite-only system to be reinstated, partly because it helps manage production, but also because it imbues the phone with, if not cachet, at least hype. OnePlus One invites were selling on eBay for up to \$100, which is ridiculous given the price of the phone. If you currently have a bit less than \$500 to splash on a phone, and if you're a user of EE or Three, you can't really go wrong with a 64GB OnePlus One (I'd ignore the cheaper 16GB model; there's really no point to that model).

INCREASE YOUR MEGAPIXELS

Let's stick with the OnePlus One for a bit longer and look at its onboard cameras – in particular, the rear-facing one that, although not spectacular, is capable of taking some extremely good photos. It sports a 13-megapixel sensor, which isn't up there with this year's flagship phones, but will be ample if you're not doing severe crops. It wasn't so long ago that camera reviews were telling us no-one needed more than four megapixels!

More important than megapixel count is the sensor and lens quality: the OnePlus One has a Sony Exmor IMX214 sensor, while its six-element lens features a class-leading f/2 maximum aperture, meaning it's great at taking photos in low light. The only thing missing is optical image stabilisation (OIS), but on many phones that can be more of a marketing gimmick than a useful facility. If your current phone has OIS, compare the images taken with it on and off – there probably isn't much difference. Its effect might be more noticeable if you shoot video, but it's relatively easy to add stabilisation in post-processing: you'll find a number of tools that make a good job of this, some of them even for free.

If you're running OxygenOS, Google Camera is the default camera app. It's perfectly competent, but the Cyanogen app you get with CM12S is far more flexible, offering better creative control and ultimately delivering better-quality pictures. (You can load Google Camera onto a CyanogenMod phone if you'd like to test the difference.) Google Camera does offers a couple of options missing from the Cyanogen app, though, one of which

is the Lens Blur mode. While the name suggests movement, what it actually does is help to isolate the primary subject of your photo and blur out everything else (and it's very good at it). The other feature is Photo Sphere, which is more appropriately named since it enables you to create 360-degree images. You can even contribute these to the Street View facility of Google Maps – to show the inside of your business premises, for example. If you're not interested in either of those options, however, then the Cyanogen app wins hands down.

APP HACKS

But what if I told you there was another app that could increase the resolution of your camera to 50 megapixels? You'd probably laugh at me and quote the laws of physics, lecturing me on how it's impossible to create more detail than is captured, and that the only way to get 50 megapixels from a 13-megapixel sensor is by interpolation, which is usually a very bad thing. Except that this time it's true. Chinese manufacturer OPPO has its own Android variant called ColorOS. This includes some interface tweaks and its own set of apps, one of which is a particularly clever camera app. OPPO phones are relatively new to the Australian market, but some enterprising developers have ported this camera app to the OnePlus One. The key is that the OnePlus One and OPPO's own Find 7 phone both use the same Sony image sensor, making this hack possible.

The ColorOS camera app cleverly squeezes 50 megapixels from the 13-megapixel sensor without interpolation. Although this may sound like magic, it's actually quite simple: the app takes a series of ten images in quick succession, so you don't really notice much of a delay. It then selects the best

four of these shots and stitches them together to create a huge 8,160 x 6,120 composite. It selects the four shots by looking for tiny movements – with the best will in the world, it's impossible to hold the phone perfectly still while it takes the consecutive shots – then analysing this movement and selecting three shots in which it can see the data that falls “between” the pixels of the first one. In effect, it exploits camera shake to scan the scene. This is such a simple trick that I'm astonished it isn't more common on other phones, or even in many new grown-

“This is such a simple trick that I'm astonished it isn't more common on other phones”

up cameras.

If you want to install the ColorOS camera app on your OnePlus One, there are plenty of guides available online, including videos on YouTube, but the first post in the thread at tinyurl.com/I5fj6mu probably explains it best. Essentially you download the app itself, then download and install the app's plugins, and finally install the HD picture plugin from within the app. You do this by firing up the camera app, tapping “Add Apps” and selecting “HD Picture”, which you'll see following some Chinese writing. To use it, again open the Plugins folder by swiping up from the bottom of the screen, then tap HD Picture – and that's it.

You'll experience a small delay when you take each photo as the app takes its rapid sequence of shots and merges the best four, but I'm sure you'll be impressed with the results.

OH OH!

Finally a tip that might help you in a situation where you're given a code to type into

a website, but the site refuses to accept it. In my case it happened when my local green cabinet was upgraded to FTTC; at the time I was upgrading, I also decided to switch provider. My old ISP provided a MAC key (used to migrate broadband from one provider to another, a bit like the PAC you get when you change mobile phone providers), but the new company rejected it, saying the code was invalid. I checked back with the old provider, which confirmed the code was correct, then the new one checked again and insisted it wasn't. I was now in a rather horrible stalemate situation.

After plenty of head-scratching, I realised that the last part of the code should be NE210, as opposed to NE21O. See the difference? It's probably quite obvious in the font used for this column, but to the person from the old ISP who originally read me my MAC key it wasn't, and neither was it to me when I read the letter I received a few days later. That last character looked like a zero rather than capital O to both of us, especially when following two digits: the human brain just wants to parse the code as xxnnn rather than xxnnx. Once I'd spotted this problem I amended the order and everything went through just fine, but I think there are lessons for several different groups here.

First, a lesson for people designing systems that use codes such as this one: avoid easily confused characters in your codes. Zero and upper case “O” obviously, but one “1” and lower-case “l” can also be confused, and if these codes are being printed onto packaging using a dot-matrix printer (as you'll often find with promotions on groceries) you should also avoid “B” and “8” since these can look similar, as can “2” and “Z”.

KEEP IT SIMPLE

The second lesson is for the programmers who write the code behind the web forms that accept these codes: if you know the format of a code should be xxnnx then validate it as such, so that if a user makes a mistake, you can supply a meaningful error message explaining the expected format and which character of the code is wrong. You might even include a hint to check those easily confused characters mentioned above.

Finally, the lesson for us poor users of these systems: if the system designer has been too inept to anticipate such problems, and the website programmer too lazy to properly validate your input, then be aware of the potential gotchas that these confused characters can cause. Having said that, even old hands at this stuff sometimes get caught out. Mumble, grumble... ●

✓ A very clever Chinese app can increase your phone's camera resolution to 50 megapixels – no, really





EILEEN BROWN

"I COULDN'T GET TO THE SITE TO FIND OUT WHAT FILES HAD BEEN MODIFIED. I STARTED TO PANIC"

Think you're immune to website hacks because you have some technical knowledge? As this tale of WordPress woe demonstrates, no-one is safe...

I discovered that my site had an issue. Running a workshop for a group of small businesses and entrepreneurs, I was showing attendees how to get images to the top of Google and Bing. Correctly formatting the image, using descriptive titles, and adding well-formed Alt tags will help pages climb in search results – something that many web designers forget to do when adding images to a client's site.

Part of my demonstration includes carrying out a search for an image with the term "Amastra kitten", "Clyde kitten" or "Eileen Brown kitten". This usually brings up an image of my ginger kitten Clyde to the top of Bing and Google. Then the shock: in the search results, Google had marked that my site, Amastra.com, "may be hacked". This isn't what you want to see when you're standing in front of a group of strangers, offering them tips and hints about websites.

Having finished the session – luckily, minus any further mishaps – I visited my homepage and was relieved to see that there was no obvious issue with the site. That is, until I tried to log in. I checked Google Webmaster Tools and could see a couple of anomalies. In early February, there had been a spike in activity, with visits to my site having significantly increased. This seemed odd, as I'd been too busy with work to log in to the WordPress dashboard right at the start of the month.

Looking at the Google Webmaster Search Queries tab, I noticed that a number of queries, completely unrelated to what I usually blog about, had appeared in the results. "Naked mum tumblr", "hermes belt", "louis vutton duffle bag replica" – something was most definitely up.

Upon trying to log in to the WordPress

admin page I was redirected to another page on the site. Requesting a new password wouldn't work, so I couldn't get to the site to find out what files had been modified. I started to panic. Without access to the admin console, I was stuck.

I logged in to my website through my hosting provider and had a look through the file structure. Sure enough, there were a couple of files that had been modified around the time that my site views began to rise. These included a few that looked like Google Analytics HTML files. Plus, according to the date on the site, the web config folder had changed recently.

A little more investigation suggested there was a problem with the WEB.CONFIG file placed on the root of the site. This may have been my hosting provider placing it there to account for any change in its server configuration. I wasn't aware of any recent changes. In order to get the website to give me admin access, this file needed to be disabled.

Disabling the WEB.CONFIG file meant that normal access to the site appeared to work again, except for the text permalinks

of each page. These had to remain as WordPress default links until the file was eventually changed.

Further investigation showed that the issue had probably occurred as a result of spam robots accessing the database through comments on posts. I hadn't set an age limit on comments and, through a lack of confidence with WordPress, I hadn't upgraded to the latest version of the software when prompted. My inertia had led to my site experiencing a URL injection attack.

UNDER ATTACK

URL injection attacks contain URLs that appear off the root of the site and are posted with the intention of spamming search results. Search queries for terms such as "cheap Christian Louboutin shoes" meant that the URL, hidden away on my site, had added domain relevance and therefore importance to these spam sites. This was depressing – the first website hack I'd ever experienced.

According to BuiltWith, more than 48% of sites across the web run WordPress –

✓ This is exactly what you don't want to see when in the middle of a demonstration

Amastra – Social Media Strategy Consultancy

amastra.com/ ▼

This site may be hacked.

Amastra CEO, Eileen Brown recorded a session for Everything Internet radio. In this interview she talks about Working the Crowd: Social Media Marketing for ...

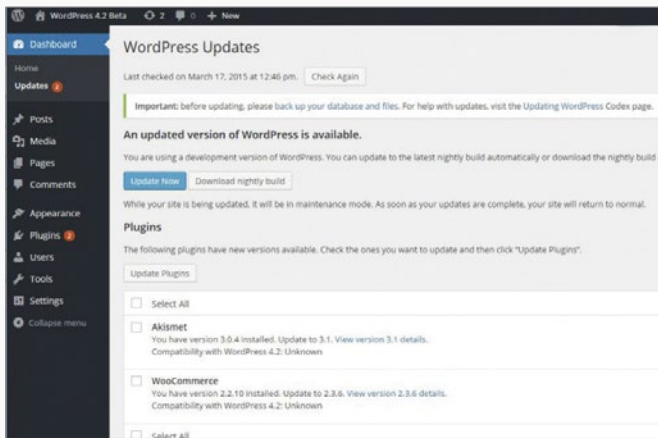


^ That sudden leap in traffic could only be due to one thing: an attack



EILEEN BROWN

is an author and social media advisor who helps businesses build their brands and create thriving communities.



< A failure to update the software had resulted in Amastra.com becoming a prime target for hackers

✓ At last, the all-clear, but not before a lot of stress and wasted hours

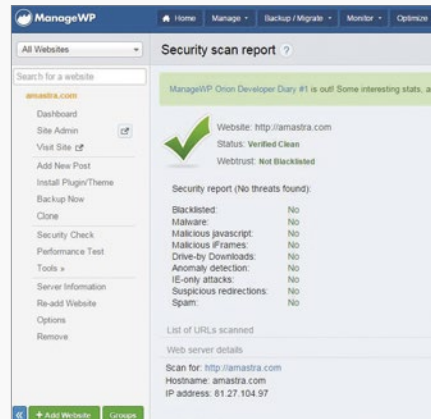
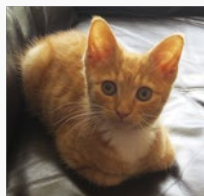
which amounts to more than 15 million self-hosted sites. Its popularity makes it a prime target for attackers, which is worrying for business owners such as myself, who don't have enough PHP or WordPress knowledge to quickly fix something that has gone awry. Only two million of these sites are running WordPress version 4.2 – the latest release – leaving the rest vulnerable to anything a hacker cares to send their way.

In hindsight, failing to upgrade my site to the latest version of WordPress was a grave error. Missing this upgrade had potentially given any hacker time to run a script across sites that hadn't been updated. Even if I had upgraded within a day or so of the 4.2 release becoming available, it might still have been too late to do anything. Zero-day exploits are becoming more and more common.

Fixing the site didn't seem straightforward, so I enlisted the help of my website designer. The whole website needed to be cleaned up, since there seemed to be some odd files in one of the root WordPress folders. We installed a scanning plugin, Wordfence, to try to get to the bottom of the issue.

Security plugins such as Wordfence and BulletProof are useful to protect your site against threats. They start by checking if the site is already infected by running a deep server-side scan of the source code, including core files, themes and plugins. Wordfence then goes on to compare each file to the official WordPress.org repository and checks each version. Then it secures the site, provides protection against known vulnerabilities such as Heartbleed, and caches files to improve its performance.

If you have administrative rights to the site, you can view the progress of the scan by logging in to the WordPress Dashboard and looking at the Wordfence tab. My ManageWP console shows that all is now thankfully clear.



After running the scan for a week, the plugin brought up only one recommendation to follow. It looks like we'd have to do a full database restore and update all of the content since the go-live date – just to make certain. How frustrating.

My delay in updating the WordPress site, not making sure that my Akismet plugin was up to date, and various other errors have cost me dearly. Not only have I wasted hours trying to chase down the issue, I have wasted my web designer's time. I've lost credibility with my clients, who have questioned what's wrong with my site; I can't embroider the truth. I have held my hands up and learned a salutary lesson from my reluctance to carry out any modifications to software I didn't know well.

On the bright side – and this is the only bright side I can find – it does mean I can talk about website hacking with first-hand experience, and help ensure my clients don't make the same mistakes.

LESSONS LEARNED

The first lesson to learn is never to be complacent. I've been using WordPress.com to blog for more than a

< Here's what people should have seen when they typed "Amastra kitten"

decade and felt confident in it. I used to post using an old copy of Windows Live Writer and didn't have to worry about spammy comments or SQL injection attempts. I managed my old website using Expression Web and knew enough basic HTML code to be able to update the site occasionally.

It was simple, but I was also aware that many small businesses used self-hosted WordPress. The benefits are clear: ad revenue and detailed analytics go directly to the business site instead of to another platform such as WordPress.com. Fear of the unknown and a lack of PHP knowledge had kept me away from self-hosted WordPress. But, after six years as a consultant I took the plunge. Four months later, my site was hacked.

What could I have done better? I could have installed a few plugins on to my site to prevent this from happening in the first place. I should have installed the UpdraftPlus plugin for WordPress as soon as my site went live. This would have taken snapshots of my WordPress site before I had made each change and uploaded them to a cloud service such as Amazon Web Services, Dropbox or Google. I could have scheduled backups to run daily, which would have allowed me to roll back the site to the day before the hack occurred.

The 404 notifier plugin should also have been installed. This would have enabled me to see which pages had been moved on the site, and alerted me to which pages no longer consisted of "pretty" URLs but were filled with URLs that looked like "?p=148" type links instead.

I should have monitored Google Webmaster Tools every week, instead of on an ad hoc basis. This would have shown me within a few days that my site visits had jumped significantly, and allowed me to remedy the situation before Google flagged my site as being hacked.

Most important of all, I should have updated the WordPress core files as soon as I was able to. I'm really efficient at patching all of my other PCs and updating my tablets and mobile devices. Why did I let this one slip? Years of using WordPress.com has made me complacent. I had trusted my site built on Expression Web a bit too much.

And that's the real lesson: complacency. I wasted ten days of effort and stress on software I didn't understand well enough to be comfortable using, but rather than put protection in place, I allowed it to slip to the back of my mind and hoped everything would be fine. That's one mistake I won't repeat. ●



DAVEY WINDER

"CAN YOU RELY UPON TRUECRYPT TO DO WHAT IT SAYS, WHICH IS TO PROTECT THE STUFF YOU ENCRYPT FROM PRYING EYES?"

With developer support for the encryption tool abandoned, would businesses be wise to still entrust their security to TrueCrypt?

There's no shortage of encryption technology out there, and this has been true since Phil Zimmermann first created Pretty Good Privacy (PGP) and released its source code into the public domain in 1991. PGP was the first public-key crypto program to gain worldwide popularity, but by 2004 TrueCrypt had taken over as the encryption solution for many individuals and business users.

The open-source nature of its code; the full-disk encryption on offer for free; the huge community of users; its "volume within a volume" plausible-deniability option; the fact that it's tried, tested and, above all, reliable and secure mean that for ten years it's ruled the roost. Despite the last release being version 7.1a in 2012, it looked as though TrueCrypt might remain as popular for the next ten years. Until 2014, that is, when its developers shocked the security community with the following announcement on their homepage:

"WARNING: using TrueCrypt is not secure as it may contain unfixed security issues. This page exists only to help migrate existing data encrypted by TrueCrypt. The development of TrueCrypt was ended in 5/2014 after Microsoft terminated support of Windows XP. Windows 8/7/Vista and later offer integrated support for encrypted disks and virtual disk images. Such integrated support is also available on other platforms... You should migrate any data encrypted by TrueCrypt to encrypted disks or virtual disk images supported on your platform."

No other reason was offered as to why support for TrueCrypt was being abandoned, or how it came to contain unfixed security issues. Not everyone

trusts the full-disk encryption built into vendors' OSes, probably even less so since the Edward Snowden revelations shone a torch into the murkier corners of state snooping and corporate co-operation. Indeed, one of the longer-running conspiracy theories surrounding the "death" of TrueCrypt has been that the security agencies had requested a backdoor be built into the software, but its developers refused and preferred to pull the plug (silently, it's suggested, because a gagging order prevented public disclosure for national security reasons). Perhaps – it is what it is, and that is dead so far as ongoing support is concerned. But does that really mean it's now unsafe to use?

IS TRUECRYPT SAFE?

I'm a fan of security expert Steve Gibson, who back in the day coded some useful security test utilities such as LeakTest (for firewall security leaks) and "UnPlug n' Pray" (to disable the insecure Windows XP UPnP feature). Although Steve has been quieter recently, I'm inclined to agree with him that it's wrong to assume that just because developer support for a once well-regarded product comes to an end, it immediately becomes untrustworthy. If TrueCrypt 7.1a was trusted for two years prior to that announcement, why not after? It probably depends from where you're approaching this: businesses will be risking their arm by using a security product that not only doesn't offer support, but actually comes with a warning not to use it; for consumers it's less clear-cut, although if you can't afford a BitLocker-compliant version of Windows then your choice may be somewhat forced. It all comes down to assurance in the security model: can you rely upon this product to do what it says, which is to protect all that you encrypt from prying eyes?

Assurance (or otherwise) for TrueCrypt users comes via an independent security audit that was recently completed. The

full "phase II" audit report can be found at tinyurl.com/q88pbnh, but I can sum up its conclusions as pretty much a "pass".

The auditors, NCC Cryptography Services, concluded that TrueCrypt is a "relatively well-designed" piece of software that contains no evidence of design flaws severe enough to make it inherently insecure, including any backdoors. However, a few concerns were raised: most importantly, in relation to the random number generator (RNG) in the Windows version, which makes the keys for encrypting TrueCrypt volumes.

This RNG was based upon a well-known legacy design from Peter Gutmann (whom regular PC Pro readers will have heard me praise for his secure data-erasure algorithm), but TrueCrypt can, in a certain set of circumstances, generate keys with it even when the CryptoAPI has failed. The chances of this causing a breach in the real world are slim, but slim chances can still punch a hole in your security posture. Without ongoing support, such design flaws can't be corrected once discovered. The auditors also identified risk related to "cache timing attack" resilience, which could potentially be used in a shared-machine environment, such as the cloud, to facilitate side-channel attacks. Once again, something you'd expect to see fixed by a point upgrade once discovered.

So does this answer the question over whether it's safe to continue using TrueCrypt? Although the audit revealed

✓ VeraCrypt is as easy to use as TrueCrypt was, but more secure. Win win!



DAVEY WINDER

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no huge vulnerabilities, it points to items that really need fixing – and this leads me to suggest that TrueCrypt isn't safe enough.

There are some obvious alternatives, the first of which for enterprise users is BitLocker; less obvious are those based on the open-source TrueCrypt code itself. The beauty of open-source software is that its code can be forked when necessary and a new project kicked off from the existing codebase. Such projects offer the advantages of the original product, while maintaining developer support and fixing any disclosed vulnerabilities. Were I in the market for a TrueCrypt-like solution then I'd be looking in the direction of one particular fork, which is called VeraCrypt.

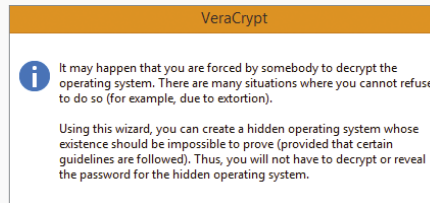
STICKING A FORK INTO VERACRYPT

While those flaws pointed out in the TrueCrypt audit are fresh in our minds, let's consider how VeraCrypt measures up for security assurance. There's no point jumping from one sinking ship to another, if both are built from the same blueprints and merely have a different captain.

It's true that VeraCrypt hasn't faced the same thorough and very public auditing process as TrueCrypt, and it could therefore contain new flaws of which we're not yet aware, but that's true of any software. So far, however, VeraCrypt has stood up to the considerable scrutiny it's received. Its developers have made it clear that they will not only provide ongoing support, but will also fix all the flaws found in the TrueCrypt audit. Indeed, as I write, the latest update (released 5 April 2015) has fixed one of the reported vulnerabilities, CryptAcquireContext, which is related to the random number generator and thought by most security experts to be the most severe. It's expected that the cache-timing attacks will be fixed too (although the fact remains that neither TrueCrypt nor VeraCrypt is intended for use in multi-user, shared-server environments anyway).

Other good news on the security-assurance front is that, since it launched in 2013, VeraCrypt has sought to address issues discovered by the lead project contributor who audited the TrueCrypt code back in 2012. French IT consultant Mounir Idrassi admits that there were no big surprises, but he felt some small things should change, leading to the birth of the VeraCrypt fork. The main perceived weakness related to the way it transformed passwords to derive keys, which was too simplistic for these days of cloud-powered key-cracking techniques.

Idrassi took a sledgehammer to crack this nut by upping the number of iterations



▲ Nice graphics, but a court order will reveal your identity

from 1,000 for standard containers and 2,000 for non-system partitions to more than 300,000 and 600,000 iterations respectively. Simply put, this makes it between ten and 300 times more difficult to crack using brute force.

On the downside, it has some impact on the speed of opening an encrypted container, but not so much that you'd notice (and certainly not enough to make you wish your data was less secure). For the record, the latest release has seen volume-mounting times on a 64-bit OS reduced by around 20%.

The other downside was that VeraCrypt used a storage format incompatible with TrueCrypt, making migration less straightforward. That's the price you pay for improved security, however.

Anyway, because VeraCrypt is being supported, its developers tend to listen to user concerns, so from version 1 VeraCrypt enables the conversion of TrueCrypt containers and non-system partitions into VeraCrypt format using "Change Volume Password" or "Set Header Key Derivation Algorithm" actions. You can download VeraCrypt at veracrypt.codeplex.com.

CERTIFICATED MADNESS MAKES MY HEART BLEED

Talking of security assurance and encryption, it's the reason we use secure protocols to connect clients to servers: assurance to both parties that the communication won't be intercepted or otherwise interfered with. Or that's the idea. Secure Sockets Layer (SSL) and Transport Layer Security (TLS), which has now replaced it, serve the same purpose: namely to encrypt and authenticate data travelling across a network between application and server that would otherwise be insecure. TLS – sometimes referred to as SSL 3.1 – is far more secure than SSL, but this is true only if you're using the latest version.

You should also be using security certificates with strong keys, extended validation and so on, all of which combine to strengthen your security but are often overlooked by people who really should know better. Did it surprise me then that, as I write this column, Instagram had just been caught forgetting to renew an expired certificate, with users receiving

warnings about unencrypted, non-private connections?

Not really, no more so than Gmail going down over Easter for some users due to another expired certificate. Without that certificate to authenticate smtp.gmail.com, many browsers refused to send any emails, which is of course exactly what they should have done if they couldn't validate the identity of Google's servers.

I mention certificates because they're at the heart of a problem slightly bigger than missed expiry and renewal dates, a problem you probably believed had gone away some time ago: Heartbleed.

It's more than a year since Heartbleed was disclosed to a rather stunned public, a vulnerability at the heart of the OpenSSL crypto library that resulted in data encrypted by SSL/TLS not being protected at all from attackers. The vulnerability itself had been present for years, since the first vulnerable version of OpenSSL (v1.0.1) was released in March 2012. Luckily, the media attention and the immediate release of a fix soon sorted things out. Or at least, it should have done... Recent research among the Forbes Global 2000 – some of the most powerful corporations on the planet – reveals that around 74% of public-facing servers are still vulnerable to Heartbleed. The reason for this is that, while the patches have been applied, the security certificates haven't been renewed alongside; both steps are required to eliminate the vulnerability.

67% of Forbes Global firms are also still vulnerable. All an attacker has to do is steal the certificate key and they can read every last byte of encrypted data. Until these certificates are replaced, these organisations remain at risk of man-in-the-middle attacks. It appears that these mega-corps, for all their resources, are failing to take this simple action because they believe that the risk has been mitigated via the application of the patch.

The longer systems remain unpatched and certificates aren't replaced, the greater the risk of someone exploiting the vulnerability. C'mon folks, patch your systems, replace private keys and revoke the old certificates – it's the only way to ensure you're safe.

AND FINALLY...

Social media firms are having a hard time of it financially at the time of writing: poor profit figures saw the share prices of both LinkedIn and Twitter tumble. This doesn't worry me personally, since I'm far more concerned about which of the big four social networks is best for the small business. Next month I'll be comparing LinkedIn with Facebook, Google+ and Twitter on that basis. ●



STEVE CASSIDY

"I WAS CONCERNED BY THE LIMITED KNOWLEDGE BOTH VICTIMS DISPLAYED OF THE SIMPLEST DEFENSIVE MEASURES"

Two tales of woe highlight the importance of always having a plan B in place

Say hello to Donny and Marie, two of my friends whose real names I shall be keeping to myself. I know you all love other people's disaster stories – and these ones are rather outside my normal brief – but both their dilemmas posed a serious question about networks, so I'm going to tell them anyway. Donny and Marie were both laptop users of the typical modern kind, lone entrepreneurs linked in to a web of friends and business affiliations mainly by email and partly via social-networking apps. One of them is remarkably well off, while the other is just about making it; one has an ancient Sony VAIO, while the other has a shiny, recent-ish MacBook Pro.

However, the possession is the opposite of what you might expect: it's penniless Marie who spent a small fortune on the MacBook, and rich Donny whose technical background helped him appreciate the shabby-chic appeal of making presentations to multimillionaire investors using a creaking plastic fossil PC. But Donny woke up one morning to discover that his trusty VAIO no longer wanted to boot, while Marie couldn't figure out what her machine was doing. All she could tell me was that its power light was on but there was nothing on the screen. Of course, both had an important meeting just the next day, and both felt that explaining the run-up to said meeting, its impact on their careers, the number of people involved, and the financial implications of not making it, would have an effect on my verdict concerning the state of their laptop.

On my side, I kind of knew the answers before I even asked the question. No, neither of them had an up-to-date backup. Yes, both had cloud accounts but had fallen out of the habit of using them. At the same time, both had been listening to the more extreme opinions about cloud reliability, which meant they'd both – spookily enough – chosen to remain at arm's length from all the automated replicators and instant uploaders of the consumer cloud software portfolio. Of course, because Donny's on a PC while Marie is staring at a black-screened MacBook, their stories rather diverge when it comes to getting stuff fixed. There's an interesting conversation to

new kit I could cram into his home office given that amount as my budget?

I hadn't completely figured it out at that moment, but by the time he was home – and I could talk to him via Skype rather than a costly international call – I had a rough idea: he could get two identical, sensible, business-grade Windows laptops; a fanless and silent managed Gigabit Ethernet switch; and a twin-drive, mirrored NAS box to at least initially provide image backups and sync. Oh, and I could fly out there with said kit, hire a Fiat 500, stay in a hotel overnight and teach him how to use it, then have a day off...

In making this suggestion I was being only mildly facetious, but that's because I had two hand-holding jobs going on at the same time and temporarily forgot that Donny is a techie. We then tiptoed cautiously around the perimeter of a hissy

"What held Marie back was that rather than fill her head with terrible techie stuff, she'd put all her faith in Apple"

fit. He was annoyed with himself, and suspicious of me for not having realised how far he'd progressed from being "just me and my laptop" to being at risk of dropping an important business deal. Just what was keeping him from working out his next set of moves rationally – namely, to remove himself from this single-machine, dangerous arena and to enter the smooth, slick world of fully backed-up, multiple-access cloud computing?

Mostly it was the deluge of information – a gross excess of it, dating back to all that hardcore, domain-centric, multi-access, hot-desk stuff that still forms the main philosophy of big-business computing – amplified by the din from the new leading edge, a thousand loudly shouted promises of hot new apps. What Donny needed was to restrict his options, to pick a NAS vendor and dive into the reality of making it work for him. Slow down a bit, do some image backups and restore cycles (a spare \$100 hard disk in the laptop is vital for this part, but well

be had here about consumer computing stuff such as guarantees, vendors and consumers' rights, which I'll cover shortly in Marie's story – but first I want to relate what happened to Donny, who was in a distant country at the time he called me in a panic.

Despite not being short of a few bob, as his choice of laptop suggests, Donny doesn't like spending money "unnecessarily" – he did at least stop to call me from the Apple Store, where they wanted \$1800 for the current MacBook Pro. I reminded him that:

- a) I had someone on hold on the other line with the same type of crisis on her MacBook, and that therefore this solution didn't automatically lead to the Promised Land.
- b) That whatever backups he might have had, restoring them to a MacBook would involve some potentially irresolvable issues over converting files.
- c) Did he have any idea just how much



STEVE CASSIDY

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✓ Proper backup measures should be in place whether you have an old Sony VAIO (above) or shiny new MacBook Pro (right)



worth it even if it does no other job for the next ten years). Eventually we found a folder-duplicator app he was happy with, working across USB keys, the NAS box and his laptops without having to drag all the files through flaky, overpopulated Spanish DSL lines to the safety of the cloud. I didn't get a trip to the sun because Donny's need was too urgent. He followed my prescription, though, and I didn't let him know my own backup/restore machine image test wasn't running on a new \$1400 Lenovo but on a Dell Vostro 1520 (whose "Celeron" badge isn't a fair description of its performance) that cost me all of \$50 on eBay.

You're all thinking now that surely Marie, penniless in Hackney, must have had an easier ride thanks to her extra spend on a spiffy Apple laptop, yes? But what held her back was that rather than fill her head with terrible techie stuff, she'd put all her faith in Apple: because Macs are easy to use when all is well, she thought they must also be easy to recover when things go wrong. And when I talk about "terrible techie stuff", here's the extent of the problem. I'd advised her to get both a display adapter and a FireWire cable to dig herself out of her disaster, and we then spent quite a lot of time on Skype (without video, but nevertheless able to transmit a wide spectrum of panicky emotions) because one of these cables wouldn't fit any of the holes with those tiny, highly designed icons beside them. She therefore concluded that the advice I'd given was probably untrustworthy and would just make things worse. After much pleading, threatening, cajoling, promising and reassuring, we finally figured out that the Amazon seller she'd bought the FireWire 800 lead from had decided to send her a USB lead instead, on the grounds that it was probably what she really needed in the first place.

This FireWire lead was actually for phase two of her recovery process: she had to keep working, which meant

getting a Mac mini so she could let go of the laptop for the period required to fix it. She'd borrowed a standalone screen – although once I saw her living room, I pointed out she could have plugged the mini straight into her flatscreen TV via HDMI – and then verified that it was only the MacBook's display that had died by plugging in the little video adapter tail. Once we knew her laptop was still alive, we ran rapidly through the Migration Assistant, which will move everything from one Mac to another over FireWire, Wi-Fi or a wired LAN. It moves your applications as well as data, even between different versions, by doing the required file conversions as it goes. It's a software tour de force, but not without a few minor niggles that mar its Hawking-like smarts. When I tried it, it lost Aperture (Apple's Photoshop competitor) but not the library of photos, which was nice, even though I now had nothing with which to view them. When Marie tried it, she hit trouble: her thoughts were mostly contained on sticky notes (either physical or onscreen), and these weren't something Apple considered vital for migration between software versions.

I had to lead Marie down the FireWire route because she's one of those home users who won't tolerate cables, but living in Hackney her Wi-Fi is almost too strong, as is that of 20 or 30 of her neighbours. There was no way to tell how long migration would take if it involved a Wi-Fi base station cat fight with 20 streaming Chromecast sessions from the flats across the road. I also wasn't going to let her go back to Amazon and be sent the wrong item again with a pat on the head from some Hong Kong techies.

Eventually, though, I had more success with her in terms of techie adaptation than I'd had with Donny. She had to

perform a fairly long-term shift to that hastily purchased Mac mini, since the screen repair to her MacBook was long, painful and expensive. As was getting all her apps over onto the migrated mini: the small shop that sold her the MacBook was being bashful about exactly where the preinstalled Microsoft Office for Mac licence had come from, and hadn't supplied her with any stickered reinstall media. This wasn't a show-stopper, however: I find Microsoft is invariably helpful in re-licensing people who ring up and are ready to pay up to get back to work. It was a red flag, though, when it came to figuring out how long it would be before she was back in action. She'd originally saved more than the cost of another new laptop by shopping outside the Apple dealer ecosystem, but she'd now had to pay almost as much to build a workable interim system before the small shop in question did the right thing and got her machine fully repaired (quite likely by taking it to an Apple Store...).

In short, I was shocked by how emotionally draining both these recovery processes turned out to be. I was concerned by the limited knowledge both victims displayed of the simplest defensive measures, or basic, home-level processes for warm-spares upkeep and testing. As a network person, naturally I went for networked fixes, but it turned out that the usable bandwidth available to the cloud from either trendy Hackney or semi-rural Spain was far less than either of them would have needed to complete a real restore without major assistance from a hardcore techie. I was also staggered by how poorly the roadmap is presented – by either the vendors or people like me – to guide such tiny businesses towards genuinely protecting themselves against nasty shocks. This



^ Apple didn't come to the rescue for Marie...but then she hadn't bought from a plush Apple Store

is why I diverted a little this month by recounting these two parallel tales, so you'll encourage your entrepreneurial friends to take more care with their Plan B decisions, purchases and expectations. And of course to redress the prejudice in their minds about Apple versus PC recoverability!

CASH-ON-DEMAND ESCAPES XP

I recently spent an afternoon taking an in-depth look at the world of cash machines (ATMs to the TLA lovers, which is confusing for me since there's also a network protocol called "ATM") courtesy of NCR, which has launched a new platform for ATMs based on Android. Yes, you heard me right, and it sounds scary doesn't it? Mr Winder has been complaining for some time about the relative insecurity of Android, as found in bazillions of flavours on the world's mobile phones, so how can an Android thin client be trusted to look after our bank-card transactions? Not to mention drive the hardened-steel shutter that rises and falls over the cash drawer and card slot on these NCR devices? Precisely by being a thin client, is the easy answer.

Most of the world's 2.5 million ATMs are currently running Windows XP, and this isn't even the worst of it. Quite a few of them got XP only recently, since NT4 and even OS/2 Warp had long, barnacle-like lifespans in this market. The slightly haggard expressions on those NCR team members with XP exposure showed that if anything, things have become worse since those far off, simpler days. The finance industry can't be seen to miss an XP update you see, no matter how it may try to secure the WANs these ATMs

sit on – but customers won't stand there watching while an ATM updates itself for 20 minutes. The support teams for ATM deployment face the same kind of contortions and catchup processes to support XP as the education sector. Neither ATM nor school deployment is exactly XP's native turf, and the last few months of the support cycle haven't been happy ones. This in part explains why NCR chose Android.

I quickly discovered, though, that for NCR it wasn't about how much Android can do for the firm, but rather how little. I'd been primed to continue thinking about Windows XP and the support nightmares it still has, even in a thin-client deployment – especially when it comes to supporting specialised hardware at the end of the connection that a thin client has with its host – so it took me some time to understand why NCR was focusing on the cloud portion of the software suite that powers these Android ATMs.

You see, there's the old thin client, and there's 21st-century thin computing. The boundary between what the client does (such as looking after that metal shutter) and what the cloud instances do has shifted out of all recognition for old Windows people. Of course, the client still has to manage a secure channel, but this no longer relies on living forever within a bank's massively protected, pan-galactic VPN. These ATMs can be plugged into any poor-quality internet connection, and will then talk back to the modules they need to link to a bank's internal systems, no

> A new platform for ATMs based on Android?
Not as scary a thought as you might expect

matter how ancient or grumpy those may be. This trick alone is justification enough for banks and other large businesses (such as mobile-phone companies) to start thinking about the advantages of an in-branch ATM, even if it isn't their main business. It also raises the prospect of ATMs that make completely different connections depending on what sort of card you put into them, which opens the door to all manner of curiosities such as Bitcoin cash cards, or cards that trigger a remote "under duress" alarm if you type in a special secondary PIN.

From NCR's perspective, far more work went into the cloud back-end software stack than into the front-end Android device-control software. Linking back into the bank's systems, which expect to converse with a bolshie XP ATM, is a tall order. Whizzy extensions could allow you to, for example, drive the ATM from your phone without ever showing it your bank card, then walk up and grab the money so quickly that people can't see what you're doing. However, this will take a sizeable shift of mindsets, and a readiness to expose internal security systems to external traffic. For me it showed promise, by moving away from Microsoft's thick-versus-thin design paradigm into a far more flexible, software-driven world. ●





AUSTRALIA NEEDS 100,000 MORE ICTWORKERS

Ry Crozier asks if the industry can shake off its image problem to attract better people?

Australia will need to find an extra 100,000 workers over the next five years if it is to keep pace with rising demand for ICT skills. The forecast is contained in Australia's Digital Pulse, a new report by ACS and Deloitte Access Economics launched by Communications Minister Malcolm Turnbull.

"We need to take urgent action to significantly enhance the ICT capabilities of our workforce," ACS President Brenda Aynsley said at the report's launch in Canberra. "We need a much larger and deeper pool of skilled ICT professionals if we are to remain a globally competitive nation."

The report found there were "around 600,000 people working in ICT-relevant occupations" in Australia – making up five percent of the Australian labour force. Of that 600,000, about half work in ICT-related industries, with the other half found in sectors that have embraced technology-driven ways of working, such as financial and professional services.

And as more industry sectors are being disrupted digitally, demand for ICT skills is increasing. "Solid jobs growth is expected for the ICT sector over the coming six years," the report stated. "Overall employment in the ICT sector is expected to grow by 2.5 percent per year over the next six years to 2020.

"This is higher than forecast growth in employment for the economy as a whole, which is forecast to grow by around 1.6 percent over the same period. "The outperformance of the ICT sector reflects its importance in Australia's workforce and its role in enabling the digital economy."

TERTIARY TROUBLES

If Australia is to find 100,000 new ICT workers in just five years, it will need to overcome several key challenges. One is the continued low number of enrolments and ICT graduates emerging from universities. Although numbers have stabilised since around 2008, they showed little signs of recovery to levels of interest in ICT studies experienced



in the early 2000s. "If you walk into universities across Australia there has been a stunning decline in enrolments and completions over the past 15 years,"

Deloitte Access Economics director John O'Mahony told the report's official launch at the National Press Club in Canberra. O'Mahony said that 15 years

"This could be contributing to the industry's image problem amongst younger generations"

ago, ICT enrolments numbered 40,000 and around 8000 students completed university studies each year. "But after the dotcom and mining boom we now have enrolments of just 27,000 students and graduations of just 5000," he said. "With that pipeline of graduates drying up the risk is we won't meet the workforce numbers needed to fuel Australia's digital economy."

SULLIED IMAGE

An equally difficult challenge is that ICT has an image problem. That problem was exemplified by a 2013 Australian Workforce Planning Authority study that noted ICT's perception as "predominantly male ICT professionals engaged in deskbound, repetitive, isolating jobs". "The argument that the sector suffers from an 'image problem' which affects its ability to attract high quality students perhaps still has merit," the new ACS/Deloitte report noted. "At a colloquial level, the ICT industry is consistently portrayed with this stereotype in popular culture (for example, in TV programs such as The IT Crowd), while other professions are gloried in terms of money and prestige in the entertainment space (such as law, finance and medicine). "This could be contributing to the industry's image problem amongst younger generations in particular."

ACS CEO Andrew Johnson urged students, parents and careers advisors to "look beyond stereotypes and see the future ICT professional with new eyes". "Digital disruption [is] creating jobs requiring ICT skills within a diverse range of sectors and professions," he said. "The data shows there is huge versatility in ICT."

For more content like this, do please visit the ACS Information Age website at <https://ia.acs.org.au>

HAM TO THE RESCUE: THE EARTHQUAKE IN NEPAL REMINDS JON HONEYBALL OF RADIO POWER

“There is a common meme out there that the net was designed to be impervious to a nuclear attack. After all, it stemmed from the American military and university worlds, and keeping the key players connected was necessary as part of the original Arpanet design.

So it isn't surprising that many believe it has the ability to cope with anything that's thrown at it. And this is true, up to a point. For example, the protocols that control routing can cope with outages in the links, rerouting around a problem, providing that particular part of the net is set up to do this. This happens at the big hubs, because outages can't be allowed to disconnect whole wedges of the internet in one swoop. It's also true that you could set up a clandestine IP gateway in a rogue state, and ensure that all the traffic continued to get through if a hostile government cut the mainstream lines.

But the reality doesn't quite live up to the “survive nuclear attack” meme. Yes, routing errors occur frequently over the internet, but they're not fixed through some magical self-correcting part of the internet organism; they're mostly fixed by the specific problem being caught and solved. A router port might go AWOL; a restart of the port fixes that problem. Someone unplugs a cable, and decides it's wise to plug it back in.

The bigger the failures, the longer they take to resolve. A digger ripping through a major fibre cable, for instance, would be a rather large setback. I'm told that one of the major bridges across the Thames carries a huge quantity of fibre-optic cable slung under it; a mis-steered barge, or a

well-placed terrorist attack, could easily cause a hiccup that would take weeks of work to patch around.

Then there's the other side of the problem, because the internet as you and I know it is only as good as the

“While the image of the older chap sat in his shed is hard to shake, ham radio is still a very valid and useful technology”

final connection path. You might have splashed out for fibre-to-the-cabinet, but you'll be disconnected just the same when a truck crashes into the shiny green box.

Things are worse when a major disaster strikes. Not only can all the end pieces become disrupted, but large sections of the core infrastructure can go down too. And then the internet really will be messed up in that location. Power failure is one obvious problem, but can be fixed relatively easily. An earthquake is on a whole different level of problem and solution. The recent terrible news coming from Nepal should underline this. A horrifying death toll, and a disaster that will take a generation to repair. As you'd expect, significant pieces of the internet in that area were simply cut off, which is exactly what you don't need in a time of crisis.

Then I read that ham radio had taken over, the somewhat quaint technology from another era. While the image of the older chap sat in his shed, asking what the weather is in Tokyo, is hard to shake,

in reality ham radio is still a very valid and useful technology. I did my exams some 30 years ago, and was given the call sign of GILMS. To get the licence, you have to pass exams and show a real proficiency for the technology and underlying physics – and understand the legal and technical responsibilities that you have.

Some of this technology is still quite amazing, and can span the globe. Ham radio played a critical part in keeping the UK government informed when the Argentinian forces invaded the Falklands in 1982, for example. On my industrial year from university, I worked with Angus McKenzie, G3OSS, who was a world-renowned radio expert. We even wrote a major technical tome for the Radio Society of Great Britain, and I still cherish my copy.

I moved away from ham radio because I discovered computers and big networks, mainframes, and the early days of Janet and the internet. For a geek like myself, this was a compelling new toy and my interest in ham waned. But the news of how ham radio is still of value in times of real crisis has stirred my memories. Maybe I should contact the authorities and get my licence re-established. It would be fun to be back online as GILMS.

After all, if the saying is right, then we're only ever a week away from sliding back to the Middle Ages. A cataclysmic loss of electricity, for example, would slide the UK towards the 19th century at a quite worrying rate. Fortunately, we're unlikely to have an earthquake or suffer the same horror as that facing Nepal. But maybe it's my responsibility to polish up the skills I used to have. You never know when they might be useful. Maybe you should look into it too.



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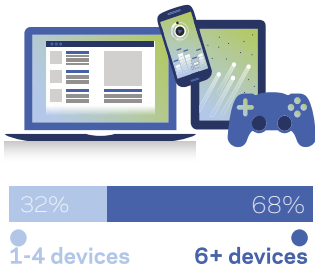
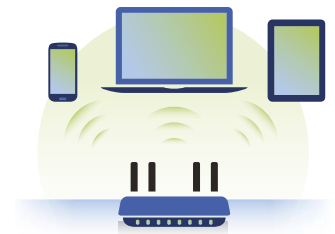
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HOME NETWORKS: MORE CROWDED THAN EVER

The average home regularly has 8+ devices connecting to the Internet — and not just for email.

- 87% of people say they simultaneously stream videos and play games, stream music, or surf the Web on multiple devices.
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SOURCE: IDC InfoBrief, sponsored by Linksys, The Home Network, Our Neglected Workhorse, published May 2015. For this report, IDC conducted a survey of 1,002 United States adults living in households of 3+ people in March 2015. This study was designed to determine how adults use their Internet-connected devices at home and their possible points in streaming video, audio, or online games.
*Three or more 1x1 MU-MIMO-enabled client devices must be connected to achieve the three (3) times faster physical data rate.



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